# Chapter 3
# Study Area Conditions

One of the most important elements of any water resources planning evaluation is defining existing resource conditions in the affected environment, and how these conditions may change in the future. The magnitude of change anticipated not only influences the scope of the problems, needs, and opportunities considered during the planning process, but also the extent of related resources that could be influenced by possible actions taken to address them. Accordingly, this chapter describes current conditions and likely future without-action conditions for resources within the study area. Defining these conditions is critical in establishing the basis for evaluating the effects of potential alternatives. This Study assumes that the future condition will occur by 2050 at the latest, although a firm date for the planning horizon is not necessary.

This chapter discusses existing and future infrastructure, resources, and other conditions in the primary study area that are of particular importance and relevance to the Study. This chapter focuses on the primary study area, but also provides information and context related to the extended study area, which includes the Truckee River Basin, Carson River Basin and Lahontan Valley, and Dixie Valley, where appropriate.

## Infrastructure

This section describes the current conditions and likely future without-action conditions related to key infrastructure in the primary study area, as well as other relevant infrastructure, used to support water storage and distribution for the Newlands Project.

### Current Conditions

Primary study area infrastructure includes Project water control and distribution facilities: major highways, rail lines and transportation corridors, as well as energy production and distribution facilities.

#### *Newlands Project*

With passage of the Reclamation Act of 1902, Reclamation began construction of Newlands Project facilities. Derby Dam was one of the first structures to be built under the Reclamation Act. Other Newlands Project facilities include Tahoe Dam, Lahontan Dam and Reservoir, Carson Diversion Dam, Old Lahontan Powerplant, the Truckee Canal, and the lateral and drainage canal system. Facilities of the Newlands Project are described below in the relative

order in which Truckee River water flows through them, first in the Truckee Division and then in the Carson Division.

**Lake Tahoe Dam** Lake Tahoe Dam (Figure 3-1), located on the lake's northwest shore in Tahoe City, California, controls the top 6.1 feet of Lake Tahoe and regulates the flow into the Truckee River. With the large surface area of the lake, this relatively small change in lake elevation produces a reservoir capacity of 744,000-acre-feet. Completed in 1913, Lake Tahoe Dam is a concrete slab and buttress structure 18 feet high and 109 feet long. Seventeen vertical gates 5 feet tall by 4 feet wide control flow into the Truckee River.

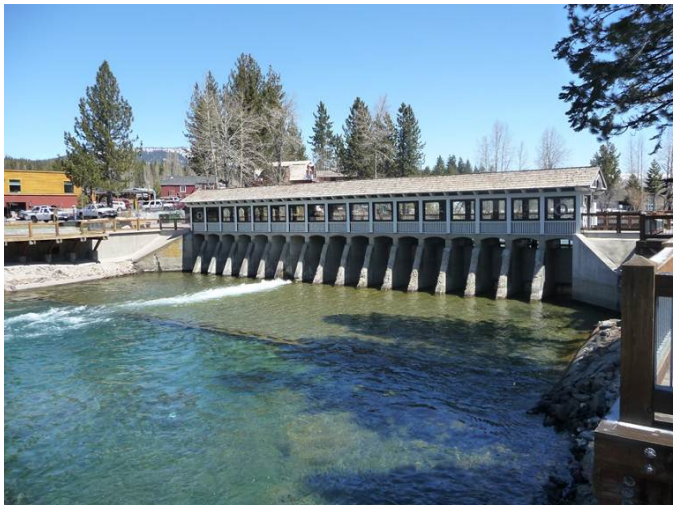


**Figure 3-1. Lake Tahoe Dam**

**Derby Dam** Derby Dam, located on the Truckee River about 20 miles downstream from Reno, diverts water into the Truckee Canal for irrigation of Truckee Division lands and for conveyance 32 miles to Lahontan Reservoir (Figure 3-2). The dam is a concrete structure 31 feet high and was completed in 1905. This was the first structure to be completed by the U.S. Reclamation Service under the Reclamation Act of 1902 (NDWR 1997).

**Truckee Canal** The Truckee Canal extends 32 miles from Derby Dam to Lahontan Reservoir. It was completed in 1905 (Figure 3-2 and 3-3). The canal serves a dual purpose: delivering water to water rights holders near Fernley and in the Hazen and Swingle Bench areas, and transporting Truckee River supplies to Lahontan Reservoir when needed to meet Carson Division demands.

**Figure 3-2. Derby Dam and Truckee Canal**

For the purpose of identifying risks associated with the Truckee Canal, Reclamation divided the canal into three "reaches," shown on Figure 3-4: the Derby Reach extends approximately 10.3 miles from Derby Dam to the TC-1 lateral diversion turnout; the Fernley Reach encompasses 11.1 miles from the TC-1 lateral to the Tedford Road Bridge; and the Lahontan Reach runs approximately

9.7 miles from the Tedford Road Bridge to the canal's outlet at Lahontan Reservoir. The January 2008 canal breach and flood occurred in the Fernley Reach.

The Truckee Canal's conveyance features include three 15.3-foot-wide tunnels ranging from 309 feet to 1,521 feet long, and includes both concrete-lined and unlined earthen canal sections. There are two wasteway structures (Derby (Pyramid) and Gilpin wasteways), two flow measurement features (Wadsworth and Hazen, located approximately 7.6 miles and 27.9 miles, respectively, downstream from Derby Dam), five check structures, fourteen laterals, and an unspecified number of takeout structures (Reclamation 2008c).

**Figure 3-3. Lined and Unlined Sections of the Truckee Canal**

The canal has an initial bottom width of 20 feet and a maximum depth of 13 feet. As designed, the canal has an initial capacity that corresponds to an unchecked flow of 1,500 cfs and an ending capacity of 900 cfs. Canal operations are discussed in the "Water Resources" section of this chapter.

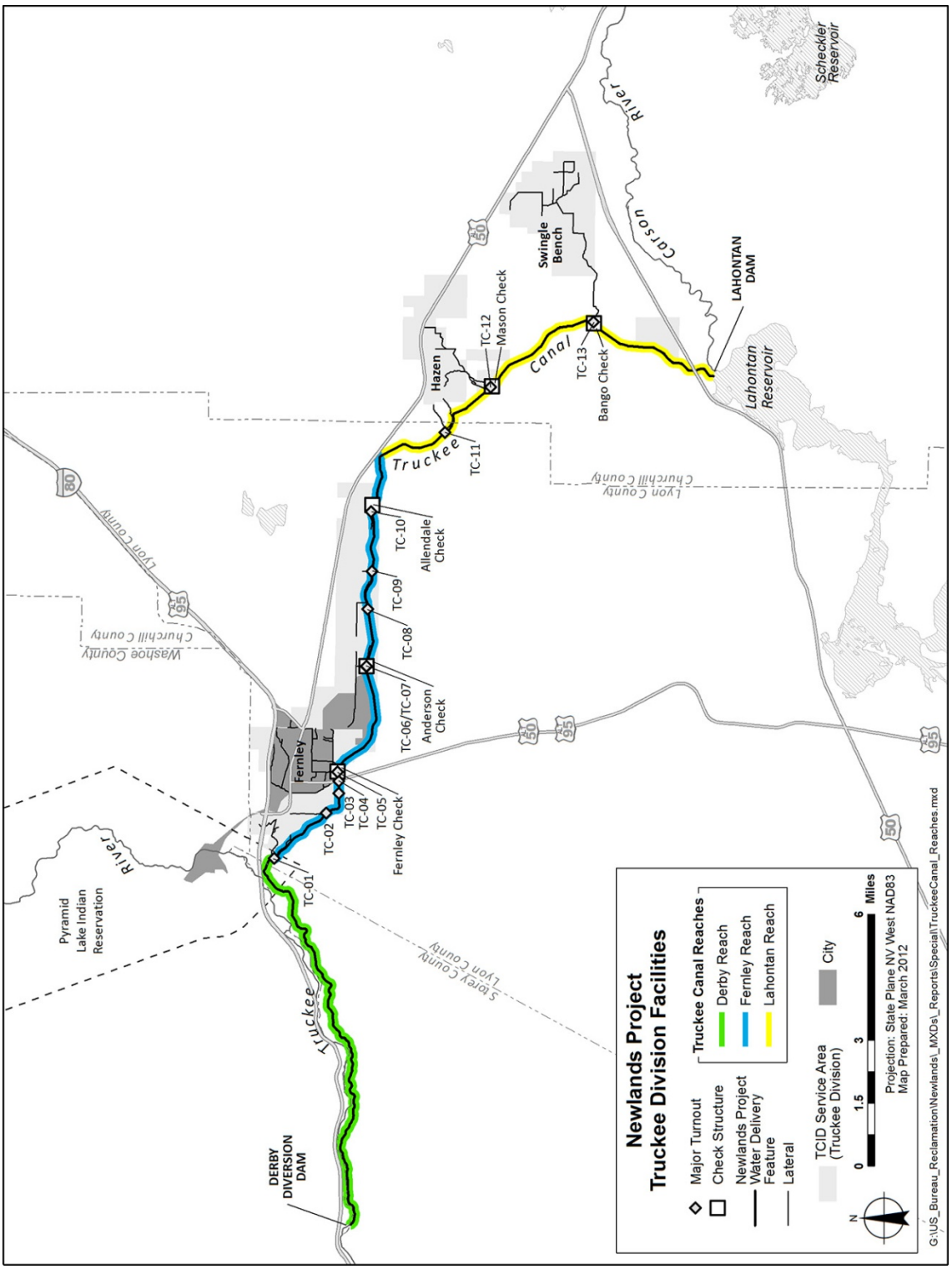



**Figure 3-4. Truckee Canal Reaches and Control Structures**

Following the January 2008 canal breach and subsequent flooding, Reclamation concerns about the safety of the Truckee Canal led to restrictions on the canal flow stages and congressional direction to investigate the risks and repairs necessary for resuming operations at capacities above 350 cfs. Risk assessments were conducted for each reach of the Truckee Canal, and for flow stages associated with 250, 350, and 600 cfs. These assessments considered the likelihood of 12 separate processes that would lead to a failure on the Truckee Canal, termed failure modes, and evaluated the potential consequences to public health and safety that would result from each. The identified general failure modes are summarized in Table 3-1, and represent a range of potential static, hydrologic, and seismic failures for the full canal structure and its individual reaches. Reclamation's standards for the safety of canals include meeting a preferred level of risk (RR3), which is discussed at length in the separate risk assessments (Reclamation 2011a, b, c, d) and also described in Chapter 1.

**Table 3-1. Summary of Potential Failure Modes Identified for the Truckee Canal**

| Number | Failure Mode | Type of Failure Mode | Description of Failure |
|---|---|---|---|
| FM1 | Canal failure due to internal erosion and piping of the embankment | Static | Tree roots, animal burrows, and other disturbances have created cavities in the canal embankment, producing pathways for seepage that extend almost or completely through the embankment. An increase in water in the canal causes water to enter the seepage points. Water flows out of the landside face of the canal embankment and begins erosion of embankment materials (piping). The type of soil or embankment condition contributes to erosion acceleration. The pipe widens rapidly, and the canal fails. |
| FM2 | Canal failure due to internal erosion and piping of the foundation | Static | As with FM1, disturbances have created pathways almost or completely through the canal foundation. An increase in water in the canal causes water to rise above the entrance to the seepage points. Water flows out of the foundation downstream from embankment toe or the landside face of canal embankment and initiates piping. The poor foundation condition contributes to the progression of the erosion, and the canal fails. |
| FM3 | Failure through the embankment caused by loss of slope stability | Static | A sudden drawdown of the canal water surface could result in excess pore-pressures within the embankment. This causes a slope failure into the canal that completely blocks the flow within the canal. Water backs up, causing overtopping upstream. If the slope failure deformations are large enough, water flows behind the slumped area, further eroding the embankment and resulting in a breach. |
| FM4 | Failure due to tunnel collapse leading to overtopping of the canal | Static | During normal static conditions, a portion of the canal tunnel collapses due to loss of interlocking forces between rock blocks. The collapsed rock material blocks the flow within the canal. Water backs up, causing overtopping in the canal section upstream. Overtopping would occur at the emergency wasteways and possibly other locations. If overtopping occurs at an embankment section constructed of erodible soils, the embankment will likely wash away and cause a breach. |
| FM5 | Failure due to blockages in the canal such as ice jams and debris blockage, which results in a sudden increase in the canal water surface and subsequent failure due to piping or overtopping | Static | An ice jam forms in the canal during winter diversions or debris is deposited in the canal any time during the year, blocking the flow of water. The water level within the canal rises suddenly, initiating internal erosion through existing flaws and causing the canal to fail. Or, the canal does not fail and rising water levels eventually overtop the canal bank. Overtopping erodes the embankment, causing a canal breach. |
| FM6 | Failure due to overtopping caused by a large sudden increase in the canal water surface elevation during a hydrologic event | Hydrologic | A large hydrologic event occurs in the drainage basins adjacent to the canal, and precipitation causes runoff into the canal. The volume of the runoff is too great for the canal spillway and wasteways when combined with canal flows, and the canal overtops. Overtopping erodes the embankment, causing a canal breach. |

**Table 3-1. Summary of Potential Failure Modes Identified for the Truckee Canal (contd.)**

| Number | Failure Mode | Type of Failure Mode | Description of Failure |
|---|---|---|---|
| FM7 | Failure due to sediment deposition into the canal from uphill drainage creating a blockage leading to overtopping | Hydrologic | A large hydrologic event occurs in the drainage basins adjacent to the canal. The precipitation causes runoff into the canal carrying large volumes of sediment that are deposited into the invert of the canal. The canal capacity is reduced or completely impeded, causing canal flows to back up and overtop. Overtopping erodes the embankment, causing a canal breach. |
| FM8 | Failure due to internal erosion and piping caused by a large sudden increase in the canal water surface during a hydrologic event/sediment deposition | Hydrologic | A sudden increase in the canal water surface exposes a flaw, such as an animal burrow, in the embankment higher than the normal operating level of the canal, resulting in a concentrated leak. Water flows out of the landside face of the canal embankment and begins piping. The type of soil or embankment condition contributes to erosion acceleration. The pipe widens rapidly, and the canal fails. |
| FM9 | Failure due to the Truckee River undercutting the canal foundation | Hydrologic | The Truckee River migrates into the foundation of the canal embankment by natural erosion processes in the Derby Reach, undercutting the canal. The river continues to erode the foundation soils, transporting the material downstream. Eventually, enough material is removed beneath the embankment that the crest collapses and the canal overtops. Overtopping erodes the embankment, causing a canal breach. |
| FM10 | Liquefaction of the canal embankment and subsequent deformation of the canal results in failure due to overtopping or significant cracking | Seismic | An earthquake large enough to cause liquefaction of the canal embankment and/or foundation materials occurs, and liquefiable materials have enough continuity to cause instability. Once liquefaction occurs, the liquefied soils experience considerable strength loss which results in slope instability and deformation. Once the deformation occurs, canal failure occurs in one of two ways. The resulting slope failure leads to deformation and crest loss that is sufficient to intercept the canal water surface, which leads to overtopping. Overtopping erodes the embankment, causing a canal breach. Or, a severely deformed section with some amount of freeboard remains and prevents immediate overtopping and breaching of the canal remnant, but contains cracks that introduce seepage. Erosion through the embankment progresses rapidly as material escapes beyond the landside slope. Internal erosion continues, creating a channel through the canal, which ultimately collapses and leads to crest overtopping, or the developing pipe progresses to the canal water surface. Overtopping or erosion causes a canal breach. |

**Table 3-1. Summary of Potential Failure Modes Identified for the Truckee Canal (contd.)**

| Number | Failure Mode | Type of Failure Mode | Description of Failure |
|---|---|---|---|
| FM11 | A seismic event causes damage to the canal, such as a slope failure or cracking of the canal embankment, which results in failure of the canal embankment | Seismic | An earthquake occurs that is large enough to cause a slope failure of the canal embankment and/or produce defects in the canal, such as cracking of the canal embankment due to settlement of the foundation materials or offsets produced by a fault within the immediate vicinity of the canal. Once these events occur, canal failure is likely to occur in one of three ways. Slope failure leads to deformation and crest loss that is sufficient to intercept the canal water surface. Overtopping begins and erodes the embankment, causing a canal breach. Or, slope failure leads to some deformation, but some amount of freeboard remains and prevents immediate overtopping and breaching of the canal remnant. The deformed section contains cracks through the canal. The canal water surface is high enough to intercept the cracks, which introduces seepage. Erosion through the embankment progresses rapidly as material escapes beyond the landside slope. Internal erosion continues, creating a channel through the canal, which ultimately collapses and leads to crest overtopping, or the developing pipe progresses to the canal water surface. Overtopping or erosion causes a canal breach. Or, very little deformation occurs, but cracks form within the canal embankment and introduce potential seepage paths. Seepage through these cracks has enough flow to cause erosion of the canal embankment. |
| FM12 | Failure due to tunnel collapse caused by a seismic event leading to overtopping of the canal | Seismic | During a strong seismic event, a portion of the canal tunnel collapses due to loss of interlocking forces between rock blocks. The collapsed rock material blocks the flow within the canal. Water backs up, causing overtopping in the canal section upstream. Overtopping would occur at the emergency wasteways and possibly other locations where it erodes away the embankment, causing a canal breach. |

Reclamation's risk assessments provided the basis for a Corrective Action Study (Reclamation 2011e) that identified methods for resolving safety risks on the Truckee Canal and included appraisal-level cost estimates. The Corrective Action Study includes a matrix of options (Table 3-2) that consider the existing risks for each Truckee Canal reach; at flow stages of 600, 350, and 250 cfs; and identifies related actions necessary for reducing risk at the RR3 level and at two higher-risk standards (RR2 and RR1). Corrective Action Study alternatives developed to address risk at the RR3 standard also include all other actions to reduce risk at the lower levels. Meeting the RR1 and RR2 standards would address risks with a high or moderate likelihood of occurring, and/or with highest possible consequences for life and property; to meet the RR3 standard, an alternative would also address risks that present a low-hazard but are extremely likely to occur.

**Table 3-2. Levels of Risk and Risk-Reduction Required for the Truckee Canal**

| LIKELIHOOD OF FAILURE | CONSEQUENCES OF FAILURE | | | |
|---|---|---|---|---|
| | **LEVEL 1 (Low Hazard)** | **LEVEL 2 (Significant Hazard)** | **LEVEL 3 (High Hazard)** | **LEVEL 4 (High Hazard)** |
| **VERY HIGH (1/100)** | Long term action may be appropriate to maintain agency credibility **(RR3)** | Long term risk reduction action likely appropriate **(RR1)** | Immediate risk reduction action may be appropriate **(RR1)** | Immediate action likely required **(RR1)** |
| **HIGH (1/1,000)** | Monitoring likely appropriate to maintain agency credibility | Long term risk reduction action may be appropriate **(RR2)** | Long term risk reduction action likely appropriate **(RR1)** | Immediate risk reduction action may be appropriate **(RR1)** |
| **MODERATE (1/10,000)** | Monitoring may be appropriate risk management activity | Monitoring likely appropriate risk management activity | Long term risk reduction action may be appropriate **(RR2)** | Long term risk reduction action likely appropriate **(RR1)** |
| **LOW (<1/100,000)** | No further action likely needed | Monitoring may be appropriate risk management activity | Monitoring likely appropriate risk management activity | Long term risk reduction action may be appropriate **(RR2)** |
| **REMOTE** | No further action likely needed | No further action likely needed | No further action likely needed | No further action likely needed |
| **Potential Life Loss** | 0 | 0 to 1 | 1 to 10 | 10 to 100 |

Key:
RR1 .....
RR2 - - - - -
RR3 ———

As previously noted, in 2008 flow stage of 150 cfs was originally recommended as the maximum flow stage that could be safely allowed in the canal; however, Reclamation ultimately determined that limiting the Truckee Canal to flow stages of 350 cfs for the next 1-to-5 years would provide appropriately safe operations for the canal, contingent upon TCID meeting a number of requirements: preparation and implementation of a Reclamation-approved emergency action plan and standard operating procedures, and continued progress toward addressing concerns outlined in the 2008 Report of Findings. TCID satisfied these requirements for the short-term flow stage increase, and has operated the canal at a maximum flow stage of 350 cfs since May 2008.

**Figure 3-5. Lahontan Dam**

**Lahontan Dam** Lahontan Dam (Figure 3-5) is located on the Carson River and stores the river's natural flow along with Truckee River water diverted via the Truckee Canal (Figure 3-5). The dam, completed in 1915, is a zoned earthfill structure 162 feet high. To prevent seepage, a cutoff-wall extends 30 to 60 feet below the original ground surface and 6 to 8 feet above the surface and into the embankment. The reservoir has a storage capacity of 289,700 acre-feet. The dam has twin spillways, one at each end of the main dam, that discharge into a common stilling pool. The combined design capacity of the spillway system is 30,000 cfs. When 20-inch flashboards are installed on the spillway crest, up to 23,300 acre-feet of additional storage capacity is available in some years.

**Old Lahontan Powerplant** Old Lahontan Powerplant, completed in 1911, is a 1.9-megawatt (MW) plant immediately below the dam. Hydropower generation remains incidental to the primary water supply purposes of the Newlands Project, but helps generate revenue to finance TCID's operations and maintenance of the Project. The powerplant and related generation infrastructure are further described in the "Utilities" section below, and the Project's hydropower production capability is further described in Appendix B3 (Newlands Project Hydropower Generation).

**Carson Diversion Dam** Carson Diversion Dam is on the Carson River 5 miles below Lahontan Dam. The dam diverts water into two main canals to irrigate Carson Division lands. Carson Diversion Dam is 241 feet long with a 225-foot long, 31-foot high concrete control section, and has a diversion capacity of 1,950 cfs. It was completed in 1906.

**"V" and "T" Canals** Two canals carry water from Carson Diversion Dam to Project lands. The "T" Canal serves lands on the north side of the Carson River. It is 9 miles long with a bottom width of 10 feet, and has an original design capacity of 450 cfs. The "V" Canal serves lands on the south side of the river and is 27 miles long. It has a bottom width of 22 feet and an original design capacity of 1,500 cfs. The capacities of the T and V canals have been reduced by encroachment and the loss of Lewis Wasteway, respectively.

**Canal, Distribution and Drainage System** Overall, the Project has 68.5 miles of main canals with a combined original diversion capacity of 2,000 cubic feet per second. In addition to the primary canals, more than 300 miles of laterals and almost 350 miles of drains have been constructed since 1904.

**Regulating Reservoirs** Several small downstream regulatory reservoirs are designed to aid in distributing water throughout the project. These include Sheckler, Old River, S Line, and Harmon reservoirs, as shown in Table 3-3 and Figure 3-6.

**Table 3-3. Newlands Project Regulating Reservoirs**

| Reservoir Name | Approximate Capacity (acre-feet) | Purpose |
|---|---|---|
| Sheckler | 27,600 | Used only during high-flow years to capture drawdown/spill water from Lahontan Reservoir. |
| Old River | Unknown | Used only during high-flow years to capture drawdown/spill water from Lahontan Reservoir. |
| S Line | 450 | Captures excess flows for later use in the S Line Canal and is also used for delivery to one irrigator with a direct turnout |
| Harmon | 2,973 | Captures return flows and excess flows for later use in the S Line Canal. |

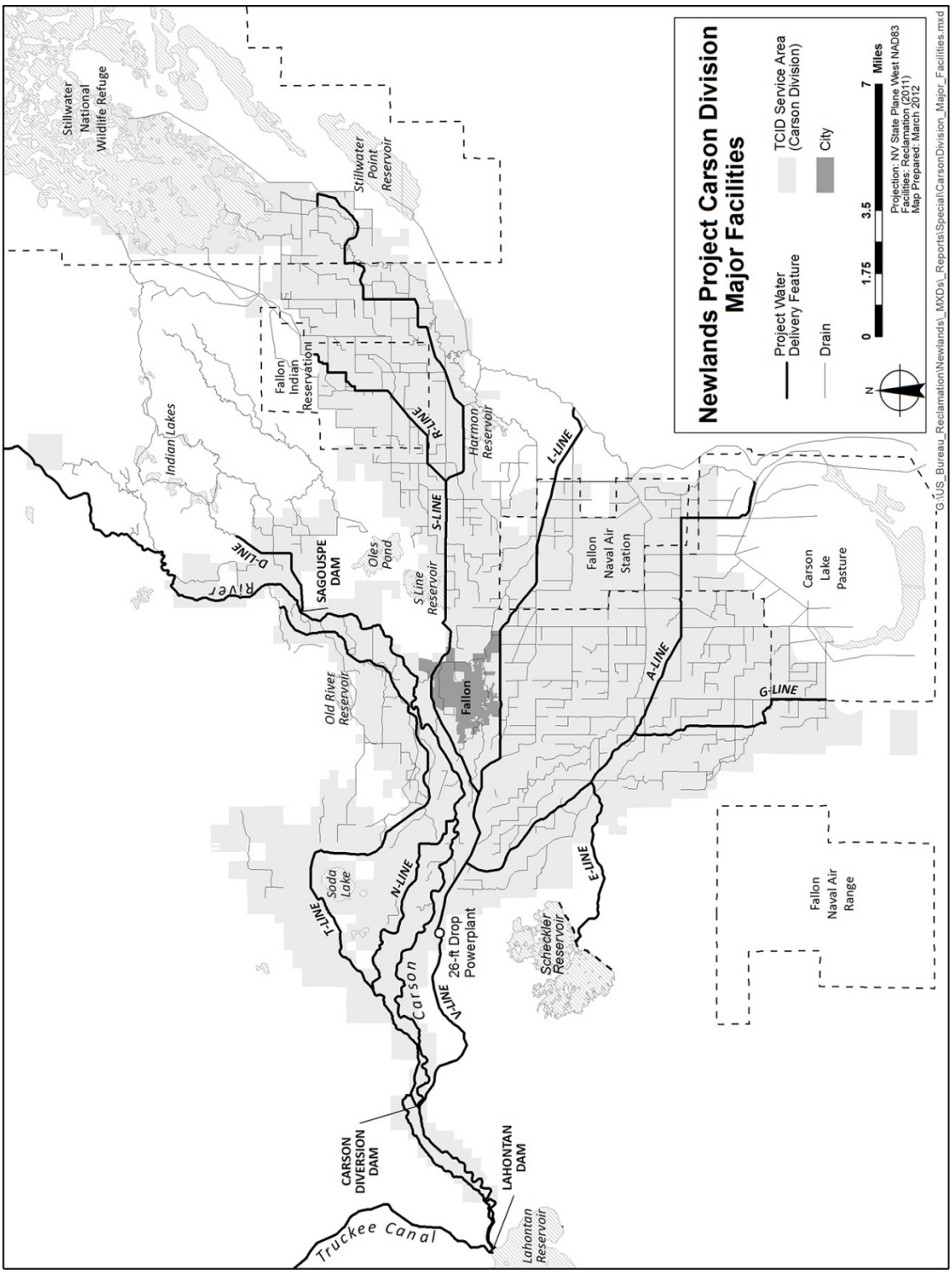



**Figure 3-6. Major Facilities of the Carson Division**

### *Transportation*

The road system in the study area consists of a section of Interstate 80 (I-80), two U.S. highways, multiple rail lines, State highways, and State, county, local, and private roads.

I-80 passes through the northwest portion of the primary study area in Washoe, Storey, Lyon, and Churchill counties in an east-west direction. From Derby Dam to roughly Fernley, I-80 runs parallel to the Truckee Canal; for most of this stretch, the highway is less than a half-mile from the canal. Fernley is the largest urban community within the primary study area served by I-80, which subsequently takes a northeastern route into the extended study area (DeLorme 2010).

U.S. Highway 50 traverses the area in an east-west direction and U.S. Highway 95 runs north-south. Both highways also have alternate routes, which provide additional access within the study area. U.S. Highway 50 runs east-west through a portion of the study area, and is a major access route for the city of Fallon and NAS Fallon. Further west, Highway 50 runs along a portion of the northern edge of Lahontan Reservoir, and is also a primary access route for Lahontan State Recreation Area (Reclamation 1991). U.S. Highway 95 runs north-south through a portion of the primary study area in Churchill County, and is a major access route for the City of Fallon (DeLorme 2010).

The Lahontan State Recreation Area contains 40 miles of State roads, both paved and unpaved, which provide access to the recreation area's entrance station, several beaches, and to campgrounds and other facilities (DeLorme 2010).

Rail lines for the Union Pacific Overland Route run alongside the Truckee River from Reno through the northern edge of Fernley, and take a northeastern turn out of the primary study area at Hazen (Union Pacific 2011, DeLorme 2010). From Hazen, Union Pacific rail lines also run southeast into Fallon, and south-southwest along the northern edges of Lahontan Reservoir through Silver Springs. Once the line reaches Wabuska, it is operated by the DOD as an access route to the Hawthorne Army Ammunition Depot.

### *Utilities*

A variety of infrastructure to support the generation and transmission of power exists in the primary study area and extended study area.

Old Lahontan Powerplant has a capacity of 1,920 kilowatts (kW), and capabilities to use water from either Lahontan Reservoir or the Truckee Canal for electricity generation purposes. Its design takes advantage of the more than 100-foot fall of the Truckee Canal into the Carson River. In 1988, TCID constructed a second powerhouse (New Lahontan) at Lahontan Dam for a single 4,000-kW generator. TCID controls operation of both Lahontan plants, and in 1999 signed a 30-year lease agreement with the Sierra Pacific Power Company

for the sale and distribution of electricity generated at the dam (Reclamation 2011f, Nevada Energy 1999). There are 73 miles of 33-kilovolt (kV) transmission lines to convey power from this plant to Fallon, Fernley, Wadsworth, Hazen, Stillwater NWR, Indian reservations, and most of the rural areas within the primary study area. The V Canal powerplant (26-Foot Drop powerplant), also constructed and owned by TCID, is on a drop in the V Canal about 6 miles west of Fallon in the Carson Division. It has two 400-kWgenerators. In 2004, TCID signed a contract with Utah Associated Municipal Power Systems for sale of power generated at this facility. Over the past five years, the three plants have produced approximately 18 gigawatt hours of electricity per year, resulting in an average $1.2 million in annual electricity sales that is used by TCID to offset O&M costs for Project users.

Geothermal resources are used, or planned for use, in several locations within the primary study area and extended study area. The four geothermal power plants within or near the primary study area are Desert Peak, Soda Lake, Bradys, and Stillwater. Transmission lines greater than or equal to 55 kV crisscross the area, with some following major roadways and some of them passing through Fernley and Fallon (Reclamation 2011j). In the extended study area, the Dixie Valley Caithness plant is Nevada's largest single geothermal power generating facility, located about 100 kilometers northeast of Fallon.

## Likely Future Without-Action Conditions

Two anticipated changes for infrastructure exist in the primary study area related to the Project: the condition and operating capacity of the Truckee Canal, and the mechanism used to deliver surface water for M&I use in the Truckee Division.

The risks identified for operating the Truckee Canal above a flow stage of 150 cfs, particularly in the urbanized sections of the canal near Fernley, require extensive correction to provide safe operation in the long term. Although in 2008, Reclamation issued TCID a short-term approval for operating at flow stages of 350 cfs, this approval is subject to reevaluation in the event that progress stalls in the development of a plan to repair the canal.

In 2011, TCID took out a $5 million bond for rehabilitating the Truckee Canal. Specifically, $2.7 million of the bond funding has financed repairs to 33 Truckee Canal conduits, or takeouts used to make deliveries to water rights holders along the canal. The repair of these conduits represents a portion of the corrective actions recommended by Reclamation, but substantial risks remain within the canal even with the completion of the conduit repair.

Under the likely future without-action condition, without detailed plans to complete Reclamation-required safety repairs to the Truckee Canal, Reclamation's approval for flow stages of 350 cfs will likely expire. A reevaluation of the canal would then be required to determine the level of flow that can be accommodated safely. Without capital improvements to the canal which satisfy Reclamation's requirements, this reevaluation is likely to result in further reductions to the allowable Truckee Canal flow stage to as low as 150 cfs, consistent with assessments of acceptable operating thresholds found in Reclamation's risk assessments (Reclamation 2011a, b, c, d).

**Likely Future Without-Action Condition**: The "Likely Future Without-Action Conditions" sections of this chapter describe the condition anticipated in the primary study area in the absence of any Federal, state, or local actions or investments to address the identified problems and risks from the Truckee Canal. It is the same as the "no-action" alternative described in NEPA regulations and includes reasonably foreseeable actions expected to occur in the future, especially those which are already authorized, funded, or permitted. For the purposes of this Study, the likely future without-action condition is assumed to occur by the year 2050. The condition provides a "baseline" against which to measure the accomplishments of the alternatives toward addressing the identified problems. The likely future without-action condition is not a prediction of what Reclamation or other agencies intend to do in the future, and does not represent a determination about the Truckee Canal's current condition, but provides an important forecast of potential future conditions that could result without implementing any of the alternatives.

The consequences of restricting the Truckee Canal to a maximum flow stage of 150 cfs have not been fully assessed; however, the Newlands Project would experience reduced water supply reliability as a result. Implications of the expected future flow-stage restrictions are described in the "Water Resources" section of this chapter and in Appendix D1 (Effects of Truckee Canal Capacity on Newlands Project Water Supply).

The future condition also includes construction of a new surface water diversion and/or delivery system by the City of Fernley to exercise its Project rights to meet its anticipated municipal demand. The city has developed a plan outlining several options for such a facility, which could include a direct intake and pipeline from the Truckee River or a diversion from the Truckee Canal, potentially at the TC-1 lateral (City of Fernley 2011a; City of Fernley 2012). While the exact mechanism for receiving deliveries of Project water rights has not yet been selected, the City of Fernley has indicated a strong commitment to aggressively pursue this action (City of Fernley 2012).

### *Key Study Assumptions*

Reclamation-required corrective actions to reduce the public safety risk of operating the Truckee Canal will not be implemented before the temporary 350 cfs flow-stage capacity restriction expires in 2013; for the purposes of this Study, the long-term Truckee Canal capacity restriction will be a flow stage of 150 cfs absent significant modification or rehabilitation. An explanation of flow stages and canal capacity restrictions appears in Appendix A (Flow-Stage Relationships for the Truckee Canal). Additionally, Fernley's surface water

rights will be served via a separate facility for diverting water directly from the Truckee River or from the Truckee Canal.

# Physical Environment

This section describes the current conditions and likely future without-action conditions related to the physical environment, topography, geology and soils, climate, air quality, and noise in the primary study area. Where pertinent to the Study, descriptions also include the resources and conditions of the extended study area.

## Current Conditions

Components of the primary study area physical environment described in this section include topography, geology and soils, climate, air quality, and noise. Water resources in the primary study area are discussed in the "Water Resources" section of this chapter.

### *Topography*

The extended study area is located in the Great Basin, a hydrographic region that includes most of Nevada, half of Utah, and portions of California, Idaho, Oregon, and Wyoming (Figure 3-7). The Great Basin includes more than 180,000 square miles of contiguous, terminal basins, having no river or ocean outlet. Rain and snowmelt dominate the hydrologic processes for streams and rivers in the Great Basin.

The crest of the Sierra Nevada mountain range forms the southwestern boundaries of the Truckee and Carson river basins in the extended study area, with elevations ranging between 5,000 and 10,000+ feet mean sea level (msl) (Reclamation 2011j).

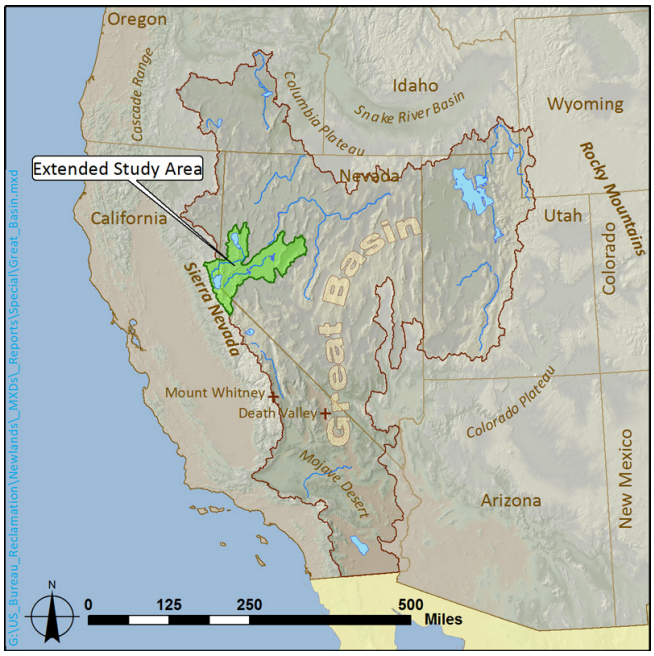



**Figure 3-7. Boundaries of the Great Basin and the Extended Study Area**

The primary study area focuses on the Newlands Project, most of which is part of the flat, northeastern end of the Carson River Basin, also called the Lahontan Valley. The Project has a less than 10 percent slope; many soils are reported with slopes of 1 percent (NRCS 2007). Elevations in the Project range from 4,213 feet at the crest of Derby Dam and 4,162 feet at the crest of Lahontan Dam to 4,150 feet in Fernley, 3,960 feet in Fallon (except for Rattlesnake Hill at 4,200 feet), and 3,870 feet where the northern end of the Stillwater NWR transitions into the Carson Sink.

The nearly level conditions within the Project influence water management practices (TCID 2010a). Wide, shallow, and slow-flowing canals and laterals deliver water within the Project. These nearly level conditions make it difficult to accurately measure water using traditional water-measuring devices that rely on a differential head to perform the measurement. The level conditions within the Project also make it harder to manage the water because of the longer time lag for water moving from one point to another. Water needs on the downstream end of the Project must be anticipated well in advance of actual needs.

### *Geology and Soils*

The current topography of the extended study area began to take shape about 25 million to 40 million years ago, when a block of granitic rock was tilted up on its east side to form the present-day Sierra Nevada (Reclamation et al. 2008). To the east, great faults broke the earth's surface, and volcanoes discharged lava and ash over much of the landscape. Uplifted, north-trending blocks formed

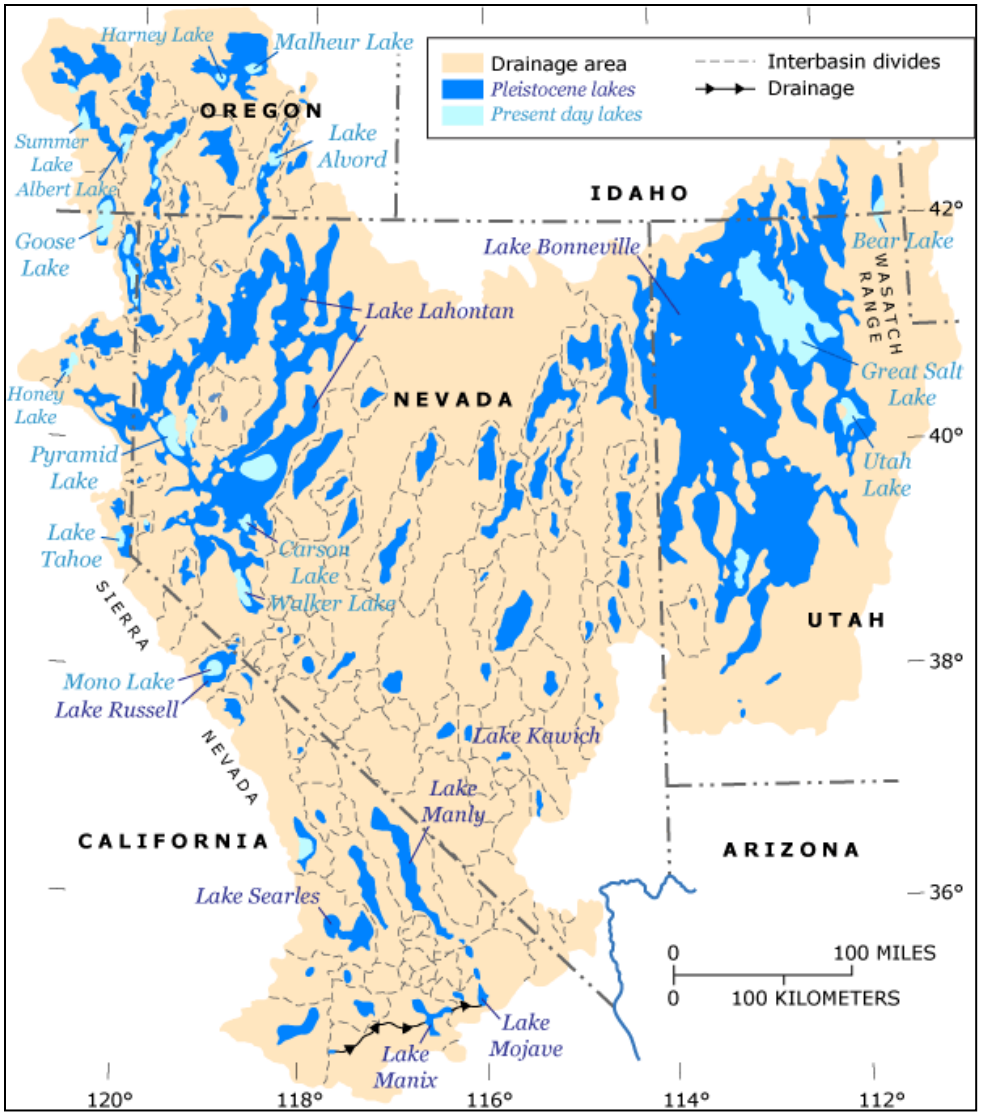
mountain ranges, and down-dropped blocks formed valleys, creating the Basin and Range topography.

By about 2 million to 3 million years ago, water filled many of the valleys of the Great Basin, at times coalescing to form huge lakes. One of these lakes was Lake Lahontan, which covered much of northwestern Nevada and a portion of northeastern California (Figure 3-8). At its maximum stage, about 50,000 years ago, Lake Lahontan occupied about 8,500 square miles. About 10,000 years ago, the climate began to warm, precipitation decreased, and Lake Lahontan receded until only a few remnants of the lake – Walker Lake, Honey Lake, and Pyramid Lake – remain today (Reclamation et al. 2008). Over thousands of years of activity and sedimentation, Lake Lahontan resulted in an estimated average sediment thickness of 3,000 feet underlying the basin (Reclamation 1990).

A historical geology continues to have localized influence in the extended study area. Throughout the Truckee River corridor, the bedrock is variably volcanic, metamorphic, and, in the lower reaches, sedimentary (Reclamation et al. 2008). In the lower Truckee River Basin, thick unconsolidated sedimentary deposits exist that have become deeply excised as the elevation of Pyramid Lake declined. Exposed tufa (calcium carbonate deposits that form below lake surfaces) provide evidence of a historically higher elevation.

The granite Sierra Nevada to the west and southwest and the volcanic Pine Nut, Desert, and Dead Camel mountain ranges to the east form the boundaries of the Carson River Basin (Tracy and Unger 2008, USGS 2011). Along the Middle Carson River, basin-fill and sand deposits line the river basin east to Lahontan Valley (USGS 2011). Downstream from Lahontan Reservoir, the geology becomes a complex combination of deposits consisting of organic-rich clays, sands, and gravels (Reclamation et al. 2008). Varying amounts of mineral salts remain in the sediments from evaporation in the internally drained basin.

The sedimentary soils in the primary study area are able to absorb large quantities of groundwater from flood irrigation and percolation from mountain streams. Further, they release large quantities of groundwater to ditches that partially or entirely rely on return flows from flood irrigation (Tracy and Unger 2008). The relatively flat soils underlying most of the primary study area are not highly susceptible to water erosion (Reclamation 2011j). Potential wind erosion ratings vary.




*Source: USGS 2012a*

**Figure 3-8. Maximum Late Pleistocene Extent of Pluvial Lakes in the Great Basin**

Periods of saturation, flooding, or ponding during the growing season develops anaerobic conditions in the upper layer of soils, creating hydric soils in the eastern portion of the primary study area (NRCS 2008). The Natural Resource Conservation Service (NRCS) classifies most of the soils in the primary study area as aridic, with sizeable areas receiving less than 8 inches of precipitation per year (Figure 3-9). Many soils in the primary study area have relatively high percentages of excess salts, including sodium, which affects soil structure and permeability, and limits vegetative species composition.

Because rainfall is low and evaporation is high, percolating rainfall is insufficient to leach salts out of the root zone. Soil salinity in the primary study

area has responded well to farming practices. Some of these soils also have aquic moisture regimes due to a spatially diverse combination of steady and seasonally high water tables. The valley floor has deep, well-drained alluvium soils with varying amounts of coarse fragments in the soil profile. Some of the alluvial fan piedmont soils at the edge of the primary study area are shallow, with a silica cemented hardpan, and may contain a clayey or fine loamy textured horizon that contains excess sodium.

According to an analysis of NRCS soil survey data, the land between Carson Sink and Carson Lake contains flat, fine-textured, and moderately fine-textured soils on floodplains (TCID 2010b). These soils formed in alluvium of mixed origins and are used for crops and pasture, where irrigated, and for range and wildlife habitat, where not irrigated. The central farming area surrounding the City of Fallon and smaller areas near Fernley and along the Carson and Truckee rivers are generally flat, coarse-textured to moderately fine-textured soils on floodplains and low stream terraces (TCID 2010b).

Farming on cropland directly affects the soils. With the high excess salts in the soils, irrigation of the cropland includes drainage canals to allow the dissolved salts to be carried away from the productive soils. The irrigated land in the primary study area is grouped broadly as nearly level soils on floodplains and low lake terraces (NRCS 2007, TCID 2010a). Most of the irrigated area is between elevations of 3,850 and 4,050 feet, with the exception of the slightly higher Truckee Division (TCID 2010a). Farmed soils within the primary study area include soils with the potential to support prime farmland, as designated by the NRCS. Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Many areas not designated as prime farmland within the primary study area have been designated as farmland of statewide importance. This designation does not include prime farmland but does include soils with a good combination of physical and chemical characteristics for the production of crops. Unlike prime farmland, farmland of statewide importance does not have any restrictions regarding soil permeability or rooting depth (Reclamation 2011j).

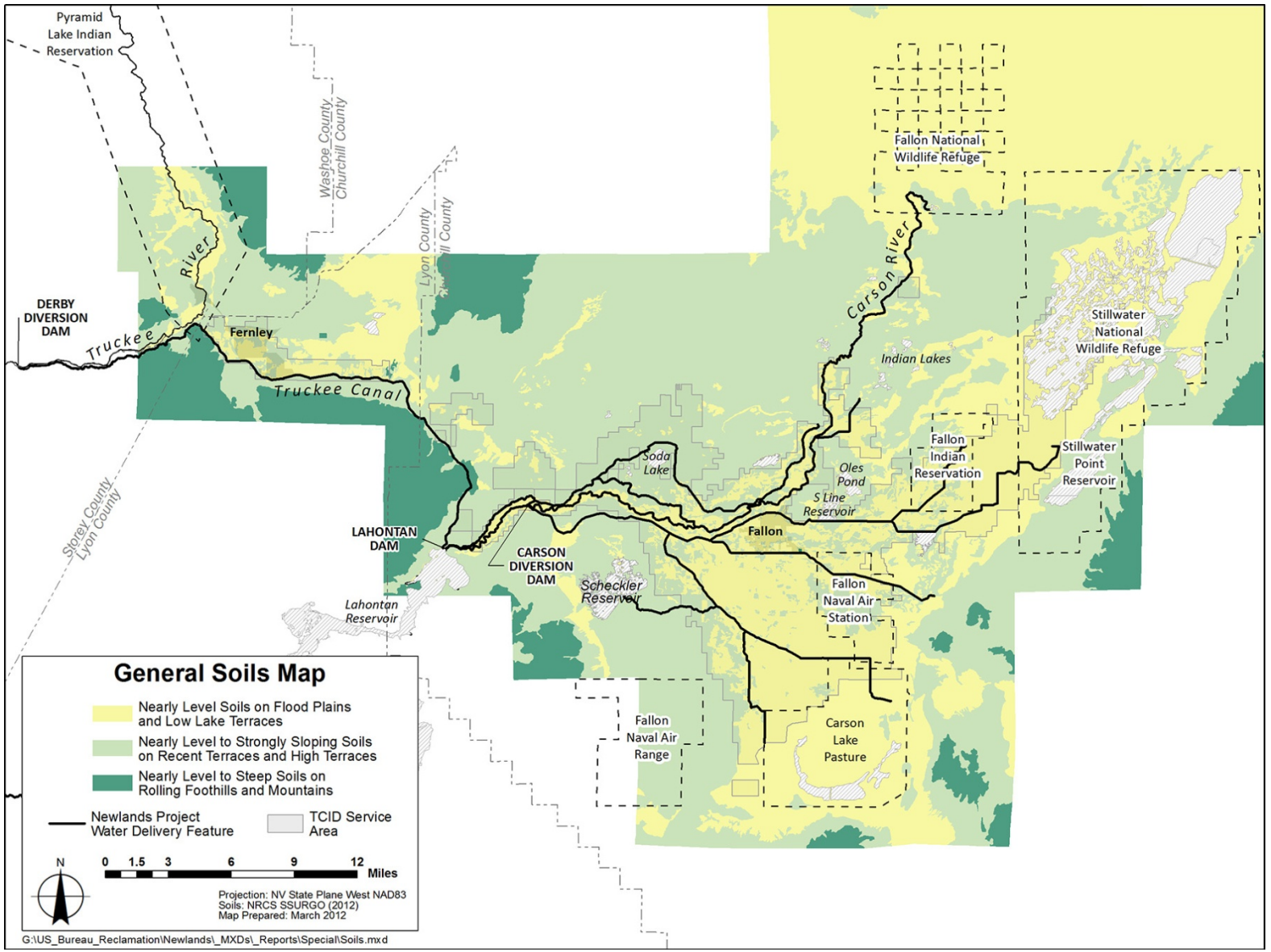



**Figure 3-9. General Soil Map of the Study Area**

### *Climate and Air Quality*

The primary study area climate is typical of the Great Basin, with long, dry winters and short, dry summers (Reclamation 2011j). Annual precipitation in the Truckee River watershed below Farad is less than 10 inches. Ten miles upstream from Lahontan Reservoir, the Carson River watershed receives less than 8 inches annually (Reclamation 2011j). Precipitation declines toward the east; annual precipitation at Fallon is less than 5 inches (WRCC 2007). Approximately 92 percent of annual precipitation falls between October and May (Kennedy/Jenks/Chilton 1988). Winter precipitation in the primary study area typically falls as rain from large-scale weather systems. Summer precipitation occurs as rain from localized activity caused by solar heating, rising air, and associated thunderstorms. Further climate statistics are shown in Table 3-4 (adapted from Reclamation 2011j).

The western ranges of the extended study area have a climate influenced by weather from the Pacific Ocean. Warm, moist air traveling east from the Pacific ascends the western slopes of the Sierra Nevada and cools, condensing the moisture, which falls almost exclusively as snow in the mountains from November to April. Moving down the eastern slope of the Sierra, the air warms and results in minimal precipitation, creating a semiarid to arid climate in the lower regions of the extended study area (Reclamation et al. 2008).

**Table 3-4. Climate Statistics for Fallon Experiment Station, 1903 – 2005**

| | October | November | December | January | February | March | April | May | June | July | August | September | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Precipitation (inches) | 0.39 | 0.38 | 0.47 | 0.53 | 0.54 | 0.45 | 0.49 | 0.61 | 0.44 | 0.16 | 0.22 | 0.29 | 4.98 |
| Evapotranspiration (inches) | 3.19 | 2.38 | 1.45 | 0.81 | 1.57 | 4.23 | 5.64 | 7.04 | 7.82 | 7.47 | 8.59 | 4.81 | 55.0 |
| Average Temperature (degrees Fahrenheit) | 51.5 | 40.1 | 32.3 | 31.2 | 37.2 | 43.4 | 49.9 | 57.7 | 65.5 | 73.0 | 70.7 | 62.1 | 51.2 |
| Maximum Temperature (degrees Fahrenheit) | 69.3 | 55.4 | 45.7 | 44.3 | 51.2 | 58.9 | 65.9 | 74.0 | 83.1 | 92.1 | 90.0 | 81.0 | 92.1 |
| Minimum Temperature (degrees Fahrenheit) | 33.7 | 24.8 | 19.0 | 18.0 | 23.1 | 27.8 | 33.9 | 41.4 | 47.9 | 53.9 | 51.3 | 43.1 | 18.0 |

Note:
Data collected at NOAA-Climatic Data Center Station 262780

Potential air quality concerns in the primary study area focus on particulate matter of 10 microns in aerometric diameter or less ($PM_{10}$) (Reclamation 2000). $PM_{10}$ sources include dust from construction and farming activities and

emissions from automobiles and aircraft. Particulate emissions in the Lahontan Valley are primarily due to the large percentage of lands that are desert with little vegetative cover. Wind blowing through the valley picks up dust from the desert floor and other exposed soils surfaces. $PM_{10}$ monitoring sites have been operational in Fallon since 1993 and in Fernley since 1995, with no exceedances of the 24-hour standard.

### Likely Future Without-Action Conditions

Physical conditions in the primary study area are expected to remain relatively unchanged in the future. No changes to primary study area topography, geology, or soils are foreseen.

However, numerous studies have projected that global and regional climates will change substantially in the future. Although this Study does not include assumptions of future climate change in its analyses, Reclamation is conducting separate investigations through the Westwide Climate Risk Assessments authorized under the SECURE Water Act of 2009 (Public Law 111-11) into how projections for future climate change may affect the study area. Initial results from these studies suggest that in the lower Truckee and Carson river basins, the overall temperature may increase 5 to 6 degrees Fahrenheit by the end of this century (Reclamation 2011l, m). The mean-annual precipitation for these basins is projected to remain relatively unchanged through 2050, and to decrease slightly during the latter half of this century. Additionally, the broader southwestern and south-central areas of the U.S. are projected to become more arid as precipitation decreases, and snowpack and runoff likewise decrease as a result, particularly during summer months.

Additionally, Reclamation has initiated several Basin Studies to investigate how potential climate changes could affect current water use (including water supply, flood control, and ecosystem needs) and to explore options for mitigating any negative consequences of climate change. Reclamation anticipates the completion of the Truckee Basin Study in 2014.

Most of the air pollutants in the study areas would continue to be influenced by both urban and agricultural land uses. If these populations grow, and more agricultural lands are converted to urban centers, a general degradation of air quality conditions could occur.

## Biological Environment

This section describes the general habitat, fishery, and wildlife resources in the study area.

## Current Conditions

The diversity of available habitats in the study areas, ranging from wetlands and riparian corridors to agricultural lands and desert shrub communities, supports numerous terrestrial species and aquatic species which are described below.

### *Vegetation and Habitat*

In general, vegetation found in the primary study area is typical of the Great Basin. Salt-tolerant shrubs and playas prevail in the lower valleys. Expanses of sagebrush and other shrub communities cover most of the higher valleys and slopes, occasionally mixed with grasses, especially at higher elevations (NDCNR 2002). There is no federally proposed or designated Critical Habitat within the study area, and no federally listed plant species are known to occur (Reclamation 2011j).

Desert plant communities in the primary study area are composed of species that can tolerate moderate to highly alkaline soils and minimal precipitation. These communities can be described as greasewood, greasewood-shadscale, saltgrass, rabbitbrush, and sagebrush communities. Greasewood-shadscale is the most prevalent community type. There are no native trees associated with these desert shrub communities.

The Carson River corridor downstream from Lahontan Reservoir supports approximately 30 miles of riparian habitat. Cottonwoods (*Populus* sect.), common in Great Basin riparian woodlands, are widespread in Lahontan Valley due to the high water table associated with irrigation activities and use of the trees for landscaping and windbreaks (Figure 3-10). In addition, Newlands Project drains and canals have created conditions that resulted in development of strips of riparian habitat. Additionally, a number of drains and canals in the primary study area contain extensive populations of willows, cottonwoods, sedges, rushes, and cattails (Reclamation 2000).

**Figure 3-10. Cottonwood Trees Adjacent to Irrigation Ditches**

Cottonwood trees surround Lahontan Reservoir, but lower reservoir operating levels and drought periods have combined to greatly reduce the number of live trees. However, the gallery

cottonwood stands and willow understory in the area west of the Lahontan Reservoir delta are some of the most complete of such habitats in Nevada.

During much of the twentieth century, wetland habitat acreage in the Lahontan Valley was reduced from historical levels as a result of upstream water diversions. The timing of delivery of water into the marsh systems and playa no longer mimics natural conditions. Inflow to current wetlands is dictated by agricultural practice and comes in a reduced, protracted flow from March through November, usually without a substantial flushing flow in the spring. Episodic flooding, usually resulting from springtime snowmelt and runoff is usually intercepted by Lahontan Reservoir and stored for downstream irrigation purposes (Reclamation 2000). At present, emergent marsh is the most dominant wetland type in the primary study area. Other wetland communities in the Lahontan Valley included open water, wet meadow, alkali mud flats/playas, and shrub. The USFWS has estimated that under typical conditions, there are approximately 16,000 acres of wetland in the Lahontan Valley (Reclamation 2000).

### *Fisheries and Aquatic Resources*

The primary study area includes marshes at Stillwater NWR, Carson Lake and Pasture, canals and historic river channels below Lahontan Dam, Lahontan Reservoir, Truckee Canal and Derby Dam. Native fish species that occur in the primary study area include tui chub (*Gila bicolor*), Lahontan redside shiners (*Richardsonius egregius*), speckled dace (*Rhinichtthus osculus*), Lahontan mountain suckers (*Catostomus platyrhynchus lahontan*), and Tahoe suckers (*Catostomus tahoensis*) (USFWS 1996a, Reclamation 2000).

Some water bodies in the primary study area have been extensively stocked in the past as part of game programs with numerous nonnative species. Nongame species generally have greater tolerance to the poor water quality found in the area (USFWS 1996a). In the past, Newlands Project regulating reservoirs and deeper wetlands in the primary study area supported a warm-water sport-fishery. Fifteen warm-water fish species have been reported to occur in Lahontan Valley. Lahontan Reservoir has historically supported one of the largest game fisheries in the State. The reservoir is eutrophic and moderately turbid, and contains numerous cool and warm-water species. Game fishing opportunities at other water bodies in the primary study area were less extensive. Wetlands at Stillwater NWR supported a number of warm-water game fish species (USFWS 1996a). The lower Carson River supported a small, seasonal cold-water fishery limited by poor habitat quality. Mercury contamination from historic mining activities in lake sediments of Lahontan Reservoir, Carson Lake, Stillwater NWR and in the floodplain of Carson River have resulted in public health advisories recommending limiting consumption of fish from these areas (EPA 2012).

Project regulating reservoirs and wetlands continued to support good fishing opportunities until drought conditions in the early 1990s significantly reduced or eliminated available water resources. Drought and requirements for greater Newlands Project water distribution efficiency have diminished the Lahontan Valley sport-fishery to the point that, except for at Lahontan Reservoir, it is nearly nonexistent (USFWS 1996a, Reclamation 2000). As in the case with Lahontan Valley wetlands, fish habitat in Lahontan Reservoir is dependent on the volume of inflow to the reservoir. During the early 1990s when drought conditions prevailed, a combination of low water levels, high water temperatures, and extensive algae growth resulted in low oxygen concentrations in the reservoir, which negatively affect the fish populations. Conditions in the reservoir improve as the volume of Carson River inflow increases due to above-average precipitation and runoff.

**Figure 3-11. Cui-ui at Marble Bluff Dam**

In the extended study area, species of particular importance include cui-ui (*Chasmistes cujus*) and Lahontan cutthroat trout (LCT) (*Oncorhynchus clarki henshawi*). Cui-ui occurs only in Pyramid Lake, with spawning runs in the Truckee River (Figure 3-11). Historically, the species spawned in the lower 43 miles of the Truckee River, but recent data indicate that spawners use less than 6 miles of the 12 miles now available. However, when sufficient flows exist, spawning cui-ui have been found in the lower 26.7 miles of the Truckee River (Reclamation 2011j). Cui-ui is federally listed as Endangered. Cui-ui are threatened by habitat alteration, such as siltation and pollution, as well as declining flow in the Truckee River.

**Figure 3-12. Lahontan Cutthroat Trout at Marble Bluff Dam**

LCT is native to lakes and streams throughout the Truckee and Carson river basins, and is listed federally as a Threatened species. Their presence in the area is owing to their presence in the historic Lake Lahontan (Figure 3-8). At one time, Lake Tahoe and Pyramid Lake contained large populations of LCT (Figure 3-12). Two distinct Pyramid Lake LCT spawning migrations once occurred in the Truckee River, spring run and fall run. Populations also occurred in Fallen Leaf, Cascade, Donner, Independence, and Winnemucca lakes.

Lacustrine LCT are found in self-sustaining populations in Pyramid and Summit lakes, and in Walker Lake through State and Federal hatchery programs. The Pyramid Lake Paiute Tribe also operates a LCT hatchery on reservation land. Small indigenous populations exist in Independence Lake and Independence

Creek in the Truckee River Basin. The Independence Lake and Independence Creek LCT population are considered important for recovery of LCT.

Though their extent is much reduced from historic levels, LCT currently occur in 155 small tributary streams with approximately 482 miles of occupied habitat throughout their range. Fluvial LCT occur in isolated headwater streams in the Truckee, Carson, and Walker river basins, as well as in an introduced population in the Desatoya Mountains in eastern Churchill County.

Principal threats to current LCT populations in the extended study area include drought, altered stream discharge and channel morphology, degraded water quality and riparian habitats, hybridization with nonnative trout, and introduced nonnative fish (Reclamation 2011j).

Also of concern in the extended study area is the tui chub found in Dixie Valley, where it lives in pools of water supported by wells and springs fed by the area's groundwater. The USFWS has indicated that the tui chub found in Dixie Valley may warrant Federal listing, but it currently has no Federal status (BLM 2001).

#### *Reptiles and Amphibians*

Two species of concern exist in the extended study area. The northwestern pond turtle (*Actinemys maromorata marmorata*), a USFS Sensitive Species, has been documented along the Carson and Truckee rivers (Reclamation 2008), and the northern leopard frog (Rana pipiens), a USFS Sensitive Species (Reclamation 2011j). Northern leopard frogs may occur in wetland areas, river channels, and irrigation canals, although their numbers have declined since the 1970s (USFWS 1996a). Several reptile species are common in the primary study area. Amphibians that may occur within the primary study area include the western toad (*Anaxyrus boreas*), and Pacific tree frog (*Pseudacris regilla*). Bullfrogs (*Rana catesbeiana*) were introduced into Lahontan Valley in the late 1800s and, despite prolonged drought, populations appear to have remained stable in the valley along riparian areas and irrigation canals (Reclamation 2000). Bullfrogs prey extensively on native fish, amphibian, and reptiles, and present a significant factor in the decline of native species (Reclamation 2011j, Reclamation 2008).

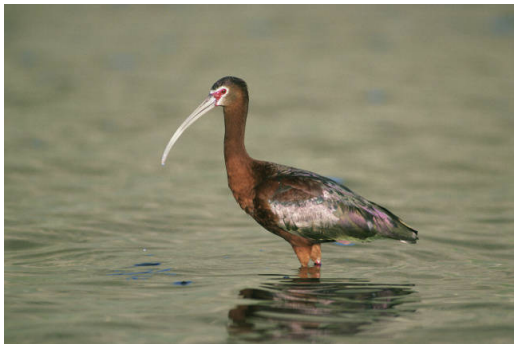
#### *Birds*

Overall diversity and the abundance of birds have declined in the Lahontan Valley. Changes in river flow regimes coupled with growth and development in the area have eliminated desirable bird habitat throughout the area. Elimination of dense riparian thickets along the Carson River has resulted in the decline of species like the black-chinned hummingbird (*Archilochus alexandri*), willow flycatcher (*Empidonax traillii*), common yellowthroat (*Geothlypis trichas*), and yellow-breasted chat (*Icteria virens*). Additionally, surveys have shown that wetland-dependent species have been adversely affected by loss of desirable wetland habitat. At least two species of ducks, three species of shorebirds, and seven species of colony nesting or marsh birds in the Lahontan Valley have

experienced declines in population or reproductive success since 1970 (USFWS 1996a, Reclamation 2000).

Species that could occur in the primary study area and that are candidates for Federal Threatened or Endangered listing are the Western yellow-billed cuckoo (*Coccyzus americanus*) and Greater sage-grouse (*Centrocercus urophasianus*). The Western yellow-billed cuckoo is a riparian species with extremely specific habitat requirements. It requires dense cottonwood or willow forested tracts of at least five acres, including a minimum of one acre of closed-canopy broadleaf forest. The Greater sage-grouse occurs in a variety of sagebrush habitats (Reclamation 2011j). Bald eagles winter in the Lahontan Valley generally between November and March (Reclamation 2011j, Reclamation 2000).

Approximately 70 species of birds use wetlands in the primary study area during migration or as breeding habitat when surface water is present. These wetlands are home to the largest breeding population of white-faced ibis (*Plegadis chihi*) in North America (Figure 3-13) (Wilds 2010). Up to 175,000 ducks, geese, and swans migrate through the valley annually, and in peak years as many as 475,000 waterfowl have been recorded in the area (Reclamation 2000). Additionally, breeding species congregate in the Lahontan Valley wetlands in large numbers (Reclamation 2011j). The number of shorebirds using the wetlands can be as high as 250,000 individuals during migration periods (Reclamation 2000).



*Source: USFWS*

**Figure 3-13. White-Faced Ibis**

The prime migratory periods for birds moving through the area are generally between August and November, and February and May of each year. As a result, approximately 430,000 acres of Lahontan Valley wetlands have been named a Globally Important Bird Area by the American Bird Conservancy (Reclamation 2011j). These primary study area wetlands have been designated as a site of international importance and are part of the Western Hemispheric Shorebird Reserve Network.

### *Mammals*

Large predatory mammals, such as coyote and mountain lion are likely to occur in open and woodland habitats within the primary study area. Mountain lions are widely distributed and are found in most mountain ranges. They occupy a limited area of Nevada, mainly along the east side of the Sierra Nevada Range and in the Carson Range.

Sagebrush communities provide perennial habitat for larger herbivorous mammals, such as mule deer and pronghorn antelope (Reclamation 2011j).

Midsized mammals, such as weasels, badgers, striped skunks, bobcats, and kit foxes, have been observed or are likely to exist in the primary study area. Of the wetland-dependent species, mink have vanished, although they were once common. Beaver and muskrat populations occur in the lower Carson River and Newlands Project canals and drains; the muskrat population is beginning to increase after being reduced during the drought period in the late 1980s and early 1990s, and their burrowing and foraging activities have also contributed to structural problems in Project canals (Reclamation 2000).

In addition, there are many species of small mammals that are likely to occur in habitat types present in the primary study area. Black-tailed jackrabbits are common to Nevada's desert and foothills, kangaroo rats inhabit deserts and grasslands, deer mice inhabit remote, rural, and urban habitats, while white-tailed antelope squirrels are adapted to a wide variety of habitats (Reclamation 2011j). Pygmy rabbits may occur in the primary study area, as this species typically inhabits dense stands of big sagebrush growing in deep loose soils. Several bat species are known to forage for invertebrates in the primary study area and roost in its various enclosed habitats (Reclamation 2011j).

## Likely Future Without-Action Conditions

Some conditions for habitat and wildlife in the primary study area and extended study area are expected to improve in the future, while others will remain static or decline. As population and urban growth continues and undeveloped lands are converted to urban uses, wildlife and plants dependent on native habitat types or on agriculture may be affected; the white-faced ibis, for example, relies on flood-irrigated agricultural lands (Reclamation 2011j).

In the primary study area, the overall quality of Lahontan Valley wetland habitat will improve in the future, as a number of organizations, led by USFWS, will acquire additional Project water rights to support wetlands at Stillwater NWR and elsewhere. USFWS's Water Rights Acquisition Program for Lahontan Valley Wetlands intends to purchase enough water rights to support a long-term average of 25,000 acres of primary wetland habitat in the Lahontan Valley at Stillwater NWR, Carson Lake and Pasture, and the Fallon Paiute-Shoshone Indian Reservation wetlands (USFWS 1996a).

In the extended study area, habitat, water quality, and water quantity will improve for wildlife and fish along the lower Truckee River and at Pyramid Lake. Under the Desert Terminal Lakes Program, Reclamation and the cities of Reno and Sparks are restoring riparian vegetation along a critical stretch of the river below Derby Dam to improve water quality and other conditions to support the LCT, cui-ui, and other resident and migratory fish species (Reclamation 2009a). The restoration action also includes providing water to Pyramid Lake via the permanent transfer of 250 acre-feet of water annually to the lower Truckee River and Pyramid Lake. In addition, as many as 2,700 acre-feet of Truckee Division water rights, to remain as instream flows in the Truckee River, will be purchased on behalf of the Pyramid Lake Paiute Tribe

under the terms of the Truckee River Water Quality Settlement Agreement with the Federal Government, the cities of Reno and Sparks, and Washoe County.

This chapter's "Socioeconomic Environment" and "Water Resources" sections and Appendix C to this report contain further explanations of the anticipated changes in land use, Project acreage and ownership, and Project demand associated with water rights acquisitions to support biological resources described above.

# Cultural Resources

This section describes current conditions and likely future without-action conditions for historic, prehistoric, and ethnographic resources in the primary study area, based on assessments produced for previous studies or for environmental review documents. Where pertinent to the Study, descriptions also include the resources and conditions of the extended study area. Also described in this section are Indian Trust Assets and fish species that are culturally important to Tribes in the primary study area and extended study area.

## Current Conditions

At present, cultural resources in the primary study area and extended study area include prehistoric and historic sites consisting of lithic scatters, habitation sites, artifacts and diversion structures (Reclamation 2000). The Nevada Cultural Resource Information System (NVCRIS) database identifies numerous cultural resource surveys within the primary and extended study areas. These surveys were primarily for archaeological resources. The NVCRIS database contains information through 2005 only, so any studies conducted since then are not included in this report. The NVCRIS database identified 987 cultural resources within the primary study area, and 458 cultural resources within the extended study area (Reclamation 2011j).

### *Historic Resources*

The Newlands Project is considered historically significant for its association with the earliest federally funded Reclamation project; for its association with the primary sponsor of the Reclamation Act of 1902, Francis G. Newlands; and for providing the irrigation water that determined the development and settlement patterns of the lower Carson River Basin (Reclamation 2009a). Additionally, prehistoric places within the extended study area have also been listed on the National Register of Historic Places (NRHP) and are close in proximity to the Newlands Project.

**Newlands Project** The Newlands Project's NRHP status has a complex history. Derby Dam was nominated and listed as an individual historic property in 1978. There was a thematic nomination in 1981 that proposed the listing of the entire Newlands Project. Only two elements, however, were actually listed at that time, Carson Diversion Dam and Lahontan Dam and Powerplant. The

remaining elements were not listed because of ambiguous boundaries, although an assumption has remained that the entire Newlands Project was, indeed, listed. In 2001, Reclamation attempted to clarify the eligibility issue of the Newlands Project and to identify criteria by which conveyance features would be eligible for inclusion in the NRHP. This evaluation led Reclamation to develop a formal Newlands Project Multiple Property Nomination in 2003, which includes a more detailed historic context. The NRHP accepted this nomination, although the only Newlands Project features actually listed on the NRHP were those structures that were previously listed. As such, although the entire Newlands Project system is generally considered eligible for listing, at this time, Project elements are still listed individually on the NRHP (Reclamation 2009a). Formally listed NRHP resources are summarized in this section.

To date, no formal eligibility determination with the Nevada State Historic Preservation Office (SHPO) concurrence has been made for the Newlands Project as a whole. Reclamation is currently consulting with SHPO on an approach to identify and document the Newlands Project as a historic district (Reclamation 2009a).

- **Lake Tahoe Dam** – This dam was individually listed on the NRHP in 1981. It was constructed between 1909 and 1913, but was not acquired by Reclamation for the Newlands Project until 1915.

- **Carson Diversion Dam** –Carson Diversion Dam was individually listed on the NRHP in 1981 as part of the thematic resource nomination for the Newlands Project. The dam is an original feature of the Newlands Project and was built between 1904 and 1905.

- **Lahontan Dam and Powerplant** – Lahontan Dam and Powerplant was listed on the NRHP in 1981 as part of the thematic resource nomination for the Newlands Project. Lahontan Dam was constructed between 1911 and 1915, as part of the Newlands Project. Due to the remote location of the dam, a hydroelectric power plant was built in association with the dam to provide power for construction activities.

- **Derby Dam** – Derby Dam was listed on the NRHP in 1978 as part of the thematic resource nomination for the Newlands Project. The dam was constructed in 1905.

**Prehistoric Resources** Two archaeological sites are located within or immediately adjacent to the primary study area.

- **Grimes Point Archaeological Site** – Grimes Point Archaeological Site, located east of the Project near NAS Fallon, was listed on the NRHP in 1972 and is one of the largest and most accessible petroglyph (rock art) sites in the United States (Reclamation 2011j). The U.S.

Department of the Interior, Bureau of Land Management (BLM) manages the site under a memorandum of agreement signed in 1976. Grimes Point is also considered an ethnographic resource.

- **Stillwater Marsh Archaeological District** – The Stillwater Marsh Archaeological District, which is within the boundaries of Stillwater NWR, was listed on the NRHP in 1974 (Reclamation 2011j). The area is culturally significant to the Paiute, particularly the nearby Fallon Paiute-Shoshone Tribe, due to the presence of ancestral remains and its ancestral use as a location for hunting and collection, and thus is also considered an ethnographic resource. Human association with Stillwater Marsh goes back at least 12,000 years (USFWS 2002). The culture and traditions of the Cattail-eater Northern Paiutes, who lived at Stillwater and Carson Lake marshes until the late 1800s (USFWS 1996), is embodied in the area's cultural resources. Because Stillwater Marsh was such an ideal place for humans to live over the millennia, Stillwater NWR contains some of the richest cultural resources in the Great Basin.

### *Indian Trust Assets*

Indian trust assets are legal interests in assets held in trust by the Federal Government for federally recognized Indian tribes or nations or for individual Indians. Assets are anything owned that has monetary value.

As part of previous Reclamation planning processes, two federally recognized tribes have identified Indian trust assets in the primary study area and extended study area: the Pyramid Lake Paiute Tribe and the Fallon Paiute-Shoshone Tribe, both located on tribal reservations in Nevada.

Trust resources of these tribes include land, water rights, and fish and wildlife, as incomes are derived from these resources. Both tribes are primarily concerned with regional water quality and quantity, water distribution, fish and wildlife, and wetlands. Assets of particular importance identified by the tribes are discussed below.

**Pyramid Lake Paiute Tribe** To protect the Pyramid Lake fishery, the Pyramid Lake Paiute Tribe maintains two hatcheries to raise LCT and cui-ui; is working cooperatively with Federal, State and private agencies to improve spawning opportunities; and seeks more inflow to Pyramid Lake, as noted previously. The tribal fishery program operates hatcheries at Sutcliffe and Numana. LCT hatcheries support a world-class fishery at Pyramid Lake that generates revenue for the tribe. The cui-ui hatchery is a "fail-safe" operation to ensure the species is maintained (Reclamation 2000).

The tribe uses a portion of the interest from the principle of the Pyramid Lake Paiute Fisheries Fund, provided under Public Law 101-618, for management of the Pyramid Lake fishery. As part of endangered and threatened species

recovery efforts, the Federal Government, in consultation and coordination with the tribe, is pursuing actions for rehabilitating lower Truckee River riparian habitat to enhance fish passage and spawning (Reclamation 2009a). Marble Bluff Dam has already been improved for fish passage and feasibility studies are underway for improving passage at Pyramid Lake. Along with conserving the fish, the tribe manages and controls fishing and hunting rights on the reservation.

**Fallon Paiute-Shoshone Tribe** The Fallon Paiute-Shoshone Tribe recognizes the importance of wetlands and the habitat they offer to birds and other wildlife. The tribe has dedicated tribal acreages for wetlands, which are served by the Newlands Project (Reclamation 2000). In addition, the tribe has expressed concern and a desire to manage the archaeologically sensitive area in Stillwater Marsh. These lands were part of the original 31,000 acres allotted to the tribe by the Federal Government. The area is of cultural significance to the tribe and represents the potential for economic and recreational development that would benefit tribal members (Reclamation 2000).

#### *Culturally Important Species*

As discussed in the biological environment section, there are two fish species occurring in the extended study area that are of cultural importance to nearby tribes (Reclamation 2011j).

**Cui-ui** Cui-ui is currently found only in Pyramid Lake. Beginning in the 20th century, changes in river discharge patterns due to construction of upstream storage reservoirs and increased water diversions for municipal and industrial and agricultural uses reduced Truckee River inflow to Pyramid and Winnemucca lakes. By 1967 Pyramid Lake's surface elevation was nearly 80 feet lower than in 1900. This caused a dramatic decline in the cui-ui population. As a consequence, the species was classified as federally endangered in 1967 (Reclamation 2000).

Cui-ui was once a major food source for the Pyramid Lake Paiute Tribe, and the tribe has historically referred to themselves as Cui-ui Ticutta, meaning "cui-ui eaters." Due to the endangered species status, the tribe has enforced a moratorium on fishing for cui-ui for nearly 3 decades. Preliminary results of recent studies indicate that the number of cui-ui adults has increased substantially due to management efforts that have included dedication of Stampede Reservoir storage to cui-ui and regulation of diversions to the Newlands Project over the last few decades as a result of OCAP (Reclamation 2000).

**Lahontan Cutthroat Trout** LCT is a native salmonid historically found throughout the Truckee and Carson river basins. Its presence throughout much of this area is attributable to the geographic extent of historic Lake Lahontan, shown in Figure 3-8. The largest populations of LCT occurred in Pyramid Lake and Lake Tahoe, where the fish was a major food source for local Indian Tribes.

The Lake Tahoe LCT fishery disappeared in 1939 as a result of the combined effects of over-fishing, exotic fish introductions, and damage to spawning habitat. By 1944, the original Pyramid Lake LCT population was extirpated by a combination of Truckee River diversions, pollution, commercial harvest, and exotic fish introductions into the main Truckee River system. USFWS classified LCT as endangered in 1970 and subsequently reclassified it as threatened in 1975 to facilitate management and allow regulated fishing on Tribal lands and elsewhere (Reclamation 2000).

### Likely Future Without-Action Conditions

Cultural resources conditions in the primary study area are unlikely to change considerably in the future. Although no specific changes are known or anticipated for the future, general trends in the primary study area, such as regional population growth and urban development, will continue to affect cultural resources and cultural landscapes through loss or disturbance of resources that are not protected, changes in setting, pressure from incremental use, and access leading to vandalism of cultural resources (Reclamation 2011j). Historic properties next to areas of growth and development are most susceptible to future impacts.

Indian trust assets and culturally important species to the region's tribes will continue to be considered when undertaking projects in the primary study area and extended study area. Members of tribal communities will continue to seek opportunities to protect the cultural and natural resources that support their traditional spiritual connections to the primary study area and the extended study area.

## Socioeconomic Environment

This section describes the current conditions and likely future without-action conditions related to the socioeconomic environment in the study area, with specific attention paid to the population and land uses that are related to the Project. The section focuses on the primary study area, but also includes the extended study area where relevant.

### Current Conditions

Socioeconomic environment describes how people live and work within the study area. This includes population growth and size, industries and employment, agricultural production and practices, land uses, recreation, and public health and safety.

#### *Population and Demographics*

The majority of the primary study area is within Churchill County, but a small portion of the area is in Lyon, Storey, and Washoe counties, as shown in Figure 3-14. Population centers within the primary study area include the communities of Fernley in Lyon County and Fallon in Churchill County. Wadsworth, in

Washoe County, is adjacent to the primary study area, as is the Lyon County community of Silver Springs on the western edge of Lahontan Reservoir. Of the communities within the primary study area, only Fallon and Fernley are incorporated as cities.

For the Project's Carson Division, data are included for Churchill County; this information includes the City of Fallon, which is the county seat and near the heart of the Newlands Project. City-level data are appropriate for use in describing the Fernley area, which is roughly equivalent to the majority of Project lands in the Truckee Division. The remainder of lands in the Truckee Division exist in the unincorporated Churchill County communities of Hazen and Swingle Bench, and the county-level data capture information about residents in these locations.

Many areas in Nevada experienced rapid population growth during the 2000s. Between 2000 and 2010, Fernley experienced a boom in growth, with the population increasing by 121.3 percent (U.S. Census Bureau 2012a). The community of Fernley first incorporated as a city in 2001. Many new housing developments occupied space previously dedicated to agricultural uses. Currently, Fernley makes up about 35 percent of Lyon County's population (U.S. Census Bureau 2012b). Although Churchill County's population only increased by 4 percent between 2000 and 2010, its largest city, Fallon, grew by an estimated 14 percent (U.S. Census Bureau 2012c, d). Currently, Fallon residents make up approximately one-third of Churchill County's population.

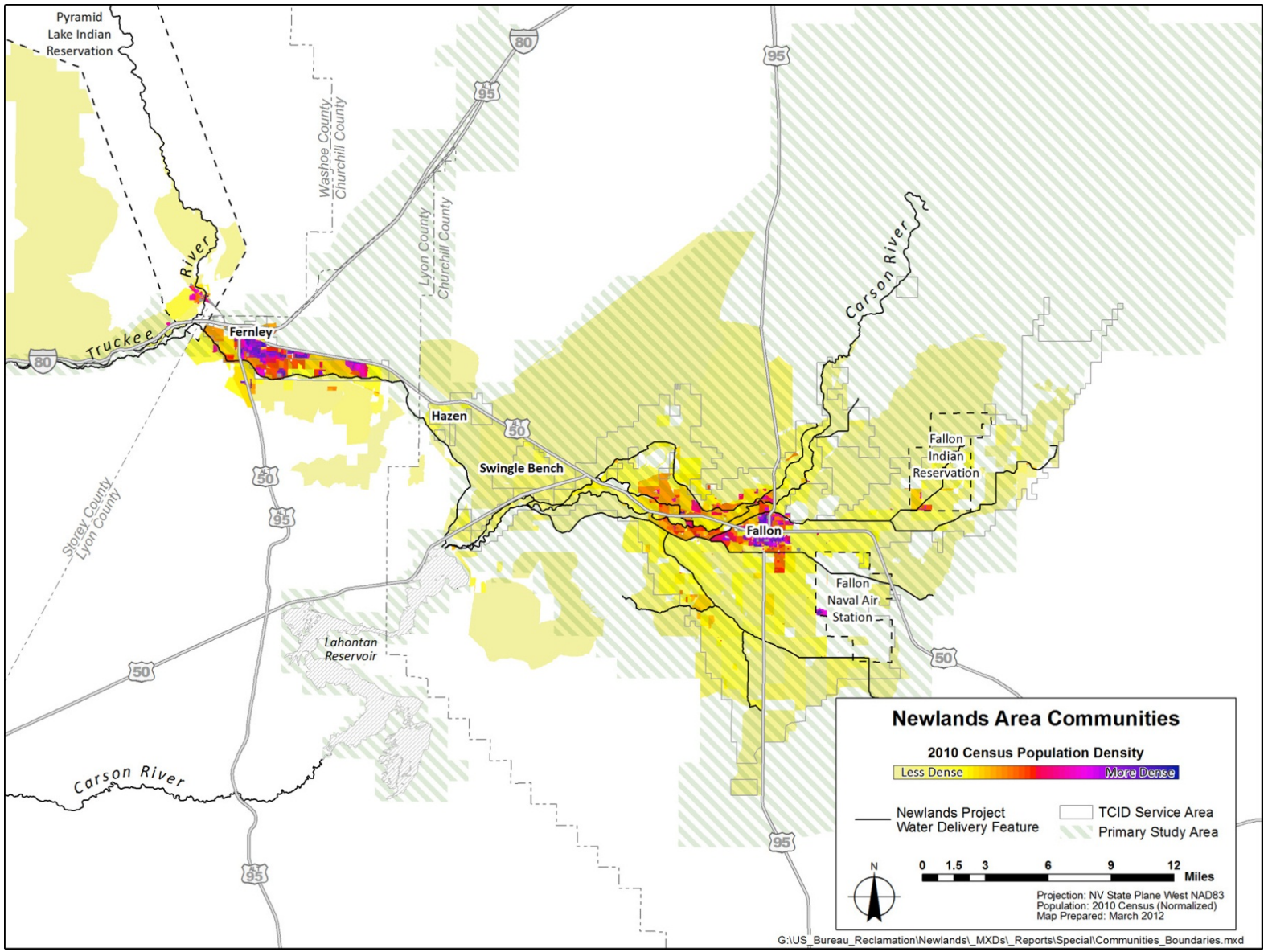



**Figure 3-14. Map of Communities and Political Boundaries in the Primary Study Area**

Fernley's population was estimated to be approximately 18,378 people (residing in 6,463 households) in 2010 (Table 3-5) (U.S. Census Bureau 2010a). Median household income in Fernley was $53,346, and median family income was $61,153. Both measures are higher than Nevada's statewide averages. Per capita income was $21,581, which is slightly lower than the State average of $27,589 (U.S. Census Bureau 2010b). Nine percent of the population and 8 percent of families lived below the poverty line.

Churchill County's population was estimated to be approximately 24,946 people (residing in 8,801 households), in 2010 (Table 3-5) (U.S. Census Bureau 2010c). Median household income in the county was $51,597, and median family income was $63,599. Per capita personal income for the county was $22,997. Nearly 9 percent of the population and 7 percent of families lived below the poverty line.

**Table 3-5. Population and Housing Demographics for Communities in the Primary Study Area**

| | Fernley, Nevada | Churchill County, Nevada |
|---|---|---|
| Population | 18,378 | 24,946 |
| Housing Units | 7,710 | 10,775 |
| Households | 6,463 | 8,801 |
| Average Household Size | 2.84 | 2.80 |
| Average Family Size | 3.44 | 3.60 |
| Median Household Income | $53,346 | $51,597 |
| Median Family Income | $61,153 | $63,599 |
| Per Capita Income | $21,581 | $22,997 |
| % of Population Below Poverty Line | 9.2 | 8.8 |
| % of Families Below Poverty Line | 8.1 | 6.8 |

*Source: 2006-2010 American Community Survey 5-Year Estimates for Fernley city and Churchill County, Nevada (U.S. Census Bureau 2010a, c)*

### *Economic Activity and Employment*

In the primary study area, economic conditions and employment largely mirror Nevada's broader trends or conditions statewide. Table 3-6 provides basic data on employment in the primary study area's communities and in Nevada overall.

**Table 3-6. Comparison of Unemployment Rates in the Primary Study Area and Statewide**

| | Unemployment Rate |
|---|---|
| Fernley, Nevada (Micropolitan Statistical Area) | 17.5% |
| Churchill County, Nevada | 11% |
| Statewide, Nevada | 13% |

*Source: BLS 2012a, b*

Note: Micropolitan Statistical Areas are larger, geographically, than city boundaries.

**Fernley** As of 2010, 18 percent of Fernley's civilian work force was employed in retail trade and about 13 percent in manufacturing (U.S. Census Bureau 2010a). Eleven percent work in each of transportation and warehousing; educational services, health care, or social services; and arts, entertainment, recreation, accommodation, or food services. The number of people employed directly in agriculture is relatively small – at most, 0.6 percent of the labor force.

**Churchill County** As of 2010, 15 percent of Churchill County's civilian work force was employed in arts/entertainment/recreation/accommodation/food services (U.S. Census Bureau 2010b). About 14 percent work in education, health care, and social services and 12 percent work in retail trade. Six percent work in agricultural and mining occupations. Over 21 percent of the work force are classified as government workers, and nearly 4 percent of the total labor force is part of the armed forces.

NAS Fallon is a key component of the local economy. As of 2006, NAS Fallon base population is about 3,000 active duty and civilian DOD personnel (NDEP 2006). Collectively, employment of Federal personnel and civilian contractors provided about $257.6 million of output for the county, about 20 percent of total county output in 2000 (Reclamation 2005).

Table 3-7 summarizes employment by industry in the primary study area.

**Table 3-7. Employment by Industry in the Primary Study Area**

| Industry | Fernley, Nevada | Churchill County, Nevada |
|---|---|---|
| Agriculture, forestry, fishing and hunting, and mining | 0.6% | 6.0% |
| Arts, entertainment, and recreation, and accommodation and food services | 10.9% | 14.9% |
| Construction | 8.0% | 7.9% |
| Educational services, and health care and social assistance | 10.9% | 13.7% |
| Finance and insurance, and real estate and rental and leasing | 4.4% | 4.3% |
| Information | 3.3% | 1.4% |
| Manufacturing | 12.5% | 7.1% |
| Other services, except public administration | 3.7% | 5.0% |
| Professional, scientific, and management, and administrative and waste management services | 7.7% | 8.9% |
| Public administration | 5.1% | 9.0% |
| Retail trade | 18.2% | 11.9% |
| Transportation and warehousing, and utilities | 10.7% | 7.6% |
| Wholesale trade | 4.0% | 2.3% |

*Source: 2006-2010 American Community Survey 5-Year Estimates for Fernley city and Churchill County, Nevada (U.S. Census Bureau 2010a, b)*

As of 2000, agricultural production contributed approximately $60 million annually to the Churchill County economy (Reclamation 2005). In terms of both output and employment, the biggest agricultural sectors were dairy, range cattle, and hay and pasture; collectively, these three sectors produced $45.08 million in product each year. Dairy farms in the county generated about $23.24 million. Hay and pasture produced approximately $13.23 million in annual sales. Ranch-fed cattle generated $8.61 million of output.

### *Agriculture*

Although agriculture is a relatively small component of the primary study area's regional economy, it is closely linked to the region's history and remains a commercially and culturally important enterprise. Because virtually all of the agricultural production in the primary study area is supported by the Newlands Project, this section focuses primarily on agricultural activities on Project lands.

**Newlands Project** Of the irrigated Project lands, 48,729 acres are dedicated to agriculture; 95 percent are in the Carson Division and 5 percent are in the Truckee Division. This Study only considers 63,596 acres of these original water rights to be active or to have the potential to be active; the remainder have been forfeited, retired, or identified for future retirement (see Appendix C, "Projected Future Water Rights and Demands for the Newlands Project).

While much of the Project land is devoted to irrigated agriculture in the production of hay and forage crops, there are a variety of land-use trends affecting the proportion of actively irrigated land in both the Truckee and Carson divisions. These include USFWS's Water Rights Acquisition Program for Lahontan Valley Wetlands in the Carson Division, the Newlands Project Water Rights Compensation Program, and efforts by Fernley and the Pyramid Lake Paiute Tribe to dedicate Truckee Division water rights for municipal and environmental uses, respectively.

The Project delivers water to 635 customers with water rights ranging in size from small residential gardens of less than 1 acre to USFWS's nearly 9,000 water-righted acres (TCID 2010a). In terms of distribution of water-righted acreage, three-quarters of the Project's individual rights are appurtenant to parcels of less than 10 acres in size; 6 percent to parcels between 50 and 100 acres in size, and approximately 3 percent to parcels larger than 100 acres. To lend some perspective to this breakdown, it should be noted that water rights with more than 100 acres comprise 53 percent of all water rights within the Project. The distribution of water right acres within the Project is noted below in Table 3-8.

**Table 3-8. Distribution of Water Rights in the Newlands Project**

| Water Right Size (Acres) | Carson Division | | Truckee Division | | Total Newlands Project | | | |
|---|---|---|---|---|---|---|---|---|
| | Individual Rights | Total Acres | Individual Rights | Total Acres | Individual Rights | Proportion of Individual Rights | Total Acres | Proportion of Total Acreage |
| 0 – 10 | 1,483 | 4,168 | 897 | 1,233 | 2,380 | 74% | 5,401 | 8% |
| 10 – 50 | 523 | 13,206 | 34 | 803 | 557 | 17% | 14,009 | 21% |
| 50 – 100 | 176 | 12,101 | 5 | 322 | 181 | 6% | 12,423 | 18% |
| 100 – 500 | 94 | 17,923 | 1 | 260 | 95 | 3% | 18,183 | 27% |
| 500+ | 9 | 17,646 | 0 | 0 | 9 | 0% | 17,646 | 26% |

Notes:
Individual rights were compiled from TCID water rights records (see Appendix C). Rights that have been identified as inactive or retired are not included in the data. TCID records are known to include over 1,300 acres of rights that are inactive and will eventually be retired by the Water Rights Compensation Program, and over 2,400 acres that are excluded from use by the Fallon Paiute-Shoshone Tribe, all within the Carson Division. Specific rights for these known inactive acreages are not identified within the TCID records and thus could not be omitted from the data presented here.
Multiple individual rights may be owned and/or managed by a single entity. Consolidated ownership of multiple individual rights is not reflected.
Key:
TCID = Truckee-Carson Irrigation District

Data in Table 3-8 contain both active acreages of water rights and acreages of water rights that are known to be inactive, but have not been specifically identified as such within TCID water rights records. The Study performed an analysis of current water rights that adjusts for the amount of acreage known to be inactive. This analysis is described in Appendix C (Projected Future Water Rights and Demands for the Newlands Project), and the resulting assessment of current water rights is summarized in Table 3-9.

**Table 3-9. Summary of Current Newlands Project Water-Righted Acres by Type of Use[1]**

| Purpose or Use | Active and Potentially Active Acres | | Inactive or Retired Acres[2] | Total Acres |
|---|---|---|---|---|
| | Carson Division | Truckee Division | | |
| Agricultural | 46,428 | 2,301 | 1,363 | 50,092 |
| Wetlands/Environmental | 11,810[3] | | 5,478[4] | 17,288 |
| Municipal and Industrial | 766 | 2,292 | | 3,058 |
| Ineligible or Forfeited[5] | | | 3,237 | 3,237 |
| **Total** | **59,003** | **4,593** | **10,079** | **73,675** |

Notes:
[1] Figures have been rounded to their whole-number equivalents; as a result, some rounding errors may exist.
[2] Water rights appurtenant to inactive or retired acres cannot be exercised now or in the future. Inactive and retired rights are treated as if they have no demand (zero acre-feet) in all analyses performed by the Study.
[3] USFWS/Stillwater NWR 8,939 acres, Carson Lake and Pasture 2,403 acres, and Fallon Paiute-Shoshone tribal wetlands 468 acres.
[4] AB 380 program 4,436 acres, Water Rights Compensation Program 66 acres, and Water Quality Settlement Agreement 976 acres.
[5] Water rights forfeited by court order, acquired by USFWS but which cannot be transferred to Stillwater NWR, or held by the Fallon Paiute-Shoshone Tribe but which exceed the cap in Public Law 101-618.

Key:
AB = Assembly Bill
USFWS = U.S. Fish and Wildlife Service
NWR = National Wildlife Refuge

Irrigated alfalfa is the dominant crop grown in the primary study area, but other crops produced include wheat, corn, barley, and vegetables, as shown in Table 3-10. Cattle ranching and dairy production are the primary livestock agricultural activities. While a large percentage of the area's forage crops are used to feed beef cattle at major commercial feed lots and on individual farms, a considerable amount of hay is also exported from the immediate area (Reclamation 1988).

**Table 3-10. Summary of Crop Types and Irrigation Methods in the Newlands Project**

| | Carson Division | Truckee Division |
|---|---|---|
| **Crop Type** | | |
| Alfalfa | 67% | 62% |
| Other Hay | 4% | 10% |
| Pasture | 15% | 26% |
| Other (corn/sudan, small grains, and vegetables) | 14% | 1% |
| **Irrigation Method** | | |
| Flood | 99% | |
| Furrow | 1% | |
| Other | <1% | |

*Source: NASS 2012, TCID 2010a*

Most of the irrigation occurs through flood methods, which is the traditional method for irrigating alfalfa. Alfalfa is the crop predominantly cultivated in the Project, particularly due to favorable climate, ability to store the crop, relatively stable and certain yields, ease of transportation, and market viability. While other crops have been grown in the Lahontan Valley, alfalfa has been the most reliable and widespread crop cultivated. "Hearts O' Gold" cantaloupes were extensively grown in the Project during the 1920s and 1930s, but weather-related conditions posed a frequent threat to the crops, and fruit often split while being shipped around the country; other fruit and beets have also been grown in the Project in past decades.

According to a report published by the University of Nevada, Reno (Darden et. al. 1999), as of 2000, the Newlands Project generated about $58 million in agricultural output (dairy, livestock, feed grains, alfalfa, other hay, and other cultivated crops); cultivated agriculture represented about 46 percent of this total (Reclamation 2000).

**Non-Project Agriculture** Several areas of agricultural production in the extended study area are also important to note for the purposes of this Study. Long before the arrival of the U.S. Reclamation Service (USRS), the precursor to Reclamation, settlers in the extended study area began creating irrigation ditches. As early as 1863, hay ranches were established in Truckee Meadows and Lahontan Valley (U.S. et al. 2008). Settlers in the lower Carson River Basin

initially fed cattle driven from Texas or California on native hay and sold both the cattle and hay to Comstock residents.

Currently, the Truckee Meadows area near Reno-Sparks includes approximately 2,125 acres of land irrigated for commercial purposes. Adjacent to the primary study area, there are approximately 1,668 irrigated acres between Derby Dam and Pyramid Lake, the majority of which are located within the Pyramid Lake Indian Reservation (Reclamation 2000). Approximately 1,200 acres of food and forage crops are irrigated by the Carson River between Dayton, approximately 22 miles southwest of the reservoir, and the Lahontan Reservoir, on the west side of the primary study area (Reclamation 2011j).

### *Land Use and Management*

Approximately two-thirds of the primary study area lands are federally owned. Reclamation manages Newlands Project withdrawn lands and has entered into several partnerships and agreements with other agencies to manage the lands subordinate to the Project's authorized purposes of irrigation, agriculture, and wetlands. The rest of the land in the primary study area is used mainly for farming, ranching, urban development, industrial enterprises, and transportation. Land uses in surrounding areas include tribal lands, DOD facilities, energy and mineral development, and recreation. Several of these are described below; agriculture and recreation are addressed in separate sections of this chapter.

The Railroad Act of 1862 has influenced part of the ownership pattern in the primary study area. Under the Railroad Act, the Federal Government gave the railroad company 10 square miles of land for each mile of track that was completed (NPS 2005). The Railroad Act granted to the railroad every other square-mile section in 20 miles each side of the railroad centerline. This act created a "checkerboard" ownership pattern of alternating private and Federal land parallel to the railroad right-of-way.

**Tribal Lands** Currently in the primary study area, the Fallon Paiute-Shoshone Tribe holds 8,020 acres of allotted and tribal trust lands in the Lahontan Valley (Reclamation 2000). A large portion of the land, 5,440 acres is appurtenant to Newlands Project water rights, although Public Law 101-618 limits irrigation to 3,025 of those acres. Some of these lands are owned by the tribe, and others are owned by individuals. The tribe has dedicated approximately 468 acres to sustain wetlands.

The Pyramid Lake Indian Reservation occupies approximately 475,085 acres, the majority of which are within the Truckee River Basin in the extended study area (Reclamation 2000).

**Wetlands and Wildlife** As noted in Chapter 1, there are multiple wildlife refuges within and adjacent to the primary study area, including the Stillwater NWR and the Fallon NWR. Stillwater NWR occupies approximately 124 square miles (about 77,000 acres) in the Lahontan Valley at the

northeasternmost edge of the Project and is classified as a Site of International Importance by the Western Hemispheric Shorebird Reserve Network due to the hundreds of thousands of shorebirds that migrate through. USFWS also owns water-righted acres in the Project and is the single largest user of Project water. The Fallon NWR is located in the Lahontan Valley near the terminus of the Carson River.

The State of Nevada manages both the Fernley Wildlife Management Area and Carson Lake and Pasture. The Fernley Wildlife Management Area, north of the city of Fernley, provides protection of wetlands and waterfowl habitat in addition to providing hunting opportunities. Carson Lake and Pasture includes 10,800 acres of wetlands and is located 8 miles southeast of Fallon (Richard Grimes, USFWS, personal communication, April 18, 2012). Carson Lake and Pasture is primarily managed for wildlife, habitat, and public use, though a portion of its lands are permitted for grazing; as with Stillwater NWR, it is a recipient of Project water.

**Defense** The NAS Fallon Main Station occupies 8,583 acres in Churchill County and includes an airfield, industrial facilities for maintaining aircraft and support equipment, business facilities, retail and recreation facilities, housing, and utilities, and is surrounded by agricultural and vacant lands that serve as a safety and noise barrier (NDEP 2006). NAS Fallon training and bombing ranges use an additional 241,338 acres, including more than 78,000 in Dixie Valley within the extended study area (BLM 2001). Bravo-16, the bombing and training range closest to the primary study area, occupies approximately 17,280 acres southwest of Fallon (NDEP 2012).

**Energy and Mineral Development** The potential for energy production, including solar, wind, biomass, geothermal, hydroelectric, oil, and gas resources, have been investigated in the primary study area and extended study area. Of these energy resource types, only geothermal resources are currently under development and are managed as leasable minerals (Reclamation 2011j). Two geothermal plants were constructed in the Lahontan Valley in the 1970s and are still operational. Geothermal energy production is also discussed in the "Infrastructure" section of this chapter.

Dixie Valley, in the extended study area, has been a proposed location for procurement of additional water sources for the Project. Current land uses for Dixie Valley include water production for Navy purposes, Navy air warfare training activities, geothermal energy production, and irrigation. Approximately 19,700 acre-feet of committed underground water rights are held by the Navy or committed to geothermal leases in Dixie Valley.

### *Public Health and Safety*

This section is a discussion of public health and safety concerns within the primary study area that are related to or affected by the Project.

**Truckee Canal** As evidenced by the 2008 canal breach and flood in Fernley, operation of the Truckee Canal presents risks to public safety in the increasingly urbanized areas through which the structure passes. As described in the "Infrastructure" and "Water Resources" sections, these risks have been investigated by Reclamation, and identified corrective actions will be included as part of this Study.

**Hazen Domestic Water Supply** Following a November 2010 dewatering of the Truckee Canal, the community of Hazen found that they were unable to obtain supplies for their reservoir. There are indications that the community was diverting water from the Hazen Pipeline, connected to the Truckee Canal, and that this water was being used for household purposes (Reclamation 2011k). Household uses of water diverted from the Truckee Canal pose public safety concerns as water diverted from the Truckee Canal is required to undergo a minimum treatment level to become potable water, per Nevada drinking water quality regulations. Water diverted at the Hazen Pipeline had not gone through the minimum treatment and thus was not considered to be potable water suitable for household use. Investigations indicated that the community of Hazen most likely did not have a valid water right for this water, and TCID sealed the pipe at Reclamation's direction in May 2011.

**Hazardous Materials** The Carson River Mercury Superfund Site consists of sediments in an approximately 50-mile stretch of the Carson River in Lyon and Churchill counties, beginning between Carson City and Dayton, Nevada, and extending downstream through the Lahontan Reservoir to Stillwater NWR. This site also includes tailing piles associated with the river (EPA 2007).

### *Recreation and Public Access*

The study area offers a large array of aquatic- and land-based recreation opportunities. Most outdoor recreation occurs on public lands under the jurisdiction of the BLM, Reclamation, USFWS, Nevada State Parks, or NDOW. The principal recreational use areas are Lahontan Reservoir State Park, Stillwater NWR, Carson Lake and Pasture, and Fort Churchill State Park, although recreation also occurs at Newlands Project regulating reservoirs, Soda and Indian lakes, and areas along the Carson and Truckee rivers.

Recreational opportunities are also available in the extended study area, most notably at Pyramid Lake and along the Truckee River. The Pyramid Lake Paiute Tribe manages lake-based recreational opportunities at Pyramid Lake. The Truckee River is a popular location for stream-based recreation, such as fishing, kayaking, and commercial rafting activities, and for picnicking.

**Recreation at Newlands Project Facilities** Lahontan Reservoir is the largest body of water in Lahontan Valley and provides opportunities for boating, fishing, and camping. Lands surrounding the reservoir are under the jurisdiction of Reclamation, but have been managed by Nevada State Parks as a park since

1971 (USFWS 1996a) under a memorandum of understanding signed by Reclamation, TCID, and the State of Nevada.

Aquatic recreational opportunities at the Lahontan State Recreation Area include fishing, boating, water skiing, and swimming (Nevada Division of State Parks 1991). The water-based recreation season at Lahontan Reservoir lasts approximately 6 months, with the bulk of annual visitation between May and August. July is a particularly important month for recreational visitation at Lahontan Reservoir, with as much as 25 percent of annual visits occurring during that month (U.S. Department of the Interior 1997).

Seventy percent of visits to Nevada's District III parks (which include Rye Patch Reservoir, Walker Lake, Fort Churchill, Belmont, and Berlin-Ichthyosaur State Park) occur at Lahontan State Recreation Area. The facility is one of the heaviest-used camping and boating parks in the State system due, in part, to its proximity to the urban areas of Reno and Carson City (U.S. Department of the Interior 1997).

Recreational use of Lahontan Reservoir is strongly tied to water level. Annual visitation to the reservoir can approach 500,000 people during average and above-average water years, but declines substantially in years when water levels are low. According to the Nevada Division of State Parks, a storage volume of 150,000 acre-feet (water elevation 4,144.9 feet) is preferred during July, the most important month for recreation at Lahontan Reservoir. A volume of 120,000 acre-feet (water elevation 4139.5 feet) is the minimum water volume for reasonable use of boat ramps at the reservoir, and below 90,000 acre-feet (water elevation 4133.3 feet), virtually no power boat use is possible (USFWS 1996a). Land-based recreation at the Lahontan State Recreation Area consists of picnicking, camping, hunting, target shooting, hunting dog trials, fishing, and use of radio-controlled boats or planes (Nevada State Parks 2007). Camping opportunities include both developed and undeveloped sites (Nevada State Parks 2007). Newlands Project regulating reservoirs include Harmon, Sheckler, S-Line, and Old River. Recreation is a secondary use of these reservoirs and is not specifically authorized as a function of the Newlands Project.

**Recreation at Study Area Wetlands** Recreation opportunities in study area wetlands include waterfowl hunting, bird-watching, sightseeing, camping, and other activities.

Hunting is permitted at Stillwater NWR, Fernley Wildlife Management Area, and Carson Lake and Pasture. Camping is also permitted at Stillwater NWR and Fernley Wildlife Management Area. Fernley Wildlife Management Area, north of Fernley, is managed by NDOW under an agreement signed by Reclamation, TCID, and the State of Nevada (U.S. et al. 2008).

An average of almost 39,000 people annually visited Stillwater NWR and Wildlife Management Area from 1994 to 1998. Of these visitors, about half were there for general recreation such as bird-watching and sightseeing. Day-use of facilities predominated and the vast majority of visitors (about 84 percent) were Fallon-area residents (USFWS 1996a). Most non-local visitors engaged in bird-watching (approximately 80 percent) originated in the Reno/Sparks area (Englin et al. 1999).

A study conducted in the Fallon area calculated average expenditures for wetlands-based recreational activities to range from $21 per person per trip for general recreationists to $38 per person, per trip for hunters (Englin et al. 1999). Based on these figures, and adjustments for inflation, and the numbers of visitors, total recreation expenditures could range from $850,000 to $2.38 million annually.

**Non-Facility Land-Based Recreation** Land-based recreation that occurs within the study area includes walking, hiking, horseback riding, picnicking, camping, hunting, wildlife viewing, and off-road vehicle use, which is restricted on Federal lands but does occur illegally.

## Likely Future Without-Action Conditions

Based on projections conducted by the Nevada State Demographer's Office both Lyon and Churchill counties are projected to continue to experience growth from 2009 to 2030 (overall growth of 2.3 percent and 0.8 percent, respectively) (Nevada State Demographer's Office 2010).

In general, the primary study area is likely to see an overall reduction in agricultural production in response to various existing programs or efforts to acquire and/or retire Newlands Project water rights in both the Truckee and Carson divisions. In the Carson Division, the result of these trends is a reduction in agriculture and an overall shift in water use that increases Project water deliveries to the Lahontan Valley wetlands. Truckee Division agriculture is expected to decrease by nearly 40 percent, with corresponding increases in demand for municipal and environmental uses. These shifts in the Truckee Division will be driven by dedications of water rights to the City of Fernley for M&I purposes, and on behalf of the Pyramid Lake Paiute Tribe for the Water Quality Settlement Agreement (Tables 3-11 and 3-12). Smaller, non-commercial farms within the Truckee Division, which have less intense water needs and are also likely to be less reliant on the commercial value of the products they produce, are expected to remain in operation and continue to require water deliveries.

**Table 3-11. Summary of Projected Future Acquisitions of Water-Righted Project Land**

| Program | Intended Use | Water Rights Acquired | |
|---|---|---|---|
| | | Acres | Source |
| USFWS Water Rights Acquisition Program | Wetlands (acres eligible for use) | 12,064 | Carson Division Irrigation Rights |
| | Wetlands (acres ineligible for use but acquired with eligible acres) | 534 | Carson Division Irrigation Rights |
| Water Rights Compensation Program | Retire | 779 | Inactive Carson Division Rights |
| | | 50 | Inactive Truckee Division Rights |
| WQSA | Remove from Project | 600 | Truckee Division Irrigation Rights |
| City of Fernley | M&I | 250 | Truckee Division Irrigation Rights |

Key:
M&I = municipal and industrial
USFWS = U.S. Fish and Wildlife Service
WQSA = Water Quality Settlement Agreement

**Table 3-12. Projected Changes in Potentially Active Newlands Project Water Rights[1]**

| | | Current (acres) | Future (acres) | Change | |
|---|---|---|---|---|---|
| | | | | (acres) | (acre-feet) |
| **Carson Division** | Ag | 46,428 | 34,363 | -12,064 | -42,500 |
| | M&I | 766 | 766 | - | - |
| | Env | 11,810 | 23,874 | +12,064 | +36,072 |
| **Truckee Division** | Ag | 2,301 | 1,451 | -850 | -3,825 |
| | M&I | 2,292 | 2,542 | +250 | +1,125 |
| | **Total** | **63,597** | **62,996** | **-600** | **-9,128** |

Note:
[1] Figures have been rounded to their whole-number equivalents; as a result, some rounding errors may exist.

Key:
Ag = Agricultural
Env = Environmental
M&I = municipal and industrial

### *Key Study Assumptions*

Overall, 14,277 acres of water-righted Project land is expected to change hands in the future, and will variously be retired or applied to a new use within the Project. The total acreage of potentially active Project water rights will decrease from 63,597 to 62,996 acres – about 1 percent of the current acreage.

In the Truckee Division, 600 acres of active or potentially active water rights for irrigation will be permanently retired from Project use. Another 250 acres of potentially active water rights for Truckee Division irrigation will be dedicated to M&I use. In the Carson Division, 12,064 acres of active or potentially active water rights for irrigation will be purchased by USFWS to support wetlands at Stillwater NWR. Appendix C (Projected Future Water Rights and Demands for the Newlands Project) contains an explanation of the analyses completed to support these assumptions.

# Water Resources

This section describes the current conditions and likely future without-action conditions related to the water resources in the primary study area, and how these are managed and used. Where pertinent to the Study, descriptions also include the resources and conditions of the extended study area.

## Current Conditions

The description of the water resources in the primary study area focuses on surface water and hydrology, ground water, water quality, and water use and management.

### *Surface Water and Hydrology*

Lake Tahoe's outlet is the source of approximately one-third of the Truckee River's flow; the remaining two-thirds derive equally from sidewater and controlled tributaries to the river. Average annual net inflow to Lake Tahoe is 180,400 acre-feet. From Lake Tahoe, the Truckee River flows generally north and east through California for about 40 miles and enters Nevada near the town of Farad, California. The main tributaries are Donner, Martis, and Prosser creeks and the Little Truckee River, all of which are regulated by dams. The unregulated drainage area produces 30 percent of the average annual runoff at Farad. Historic annual discharge of the Truckee River at Farad ranges from a low of 133,460 acre-feet in 1931 to a high of 1,768,980 acre-feet in 1983. Average annual discharge at Farad is 561,800 acre-feet (Reclamation et al. 2008). The Truckee River flows another 80 miles from Farad to Pyramid Lake. The main Nevada tributary is Steamboat Creek. A portion of Truckee River flow is diverted at Derby Dam into the Truckee Canal. Streamgage records for the Truckee River upstream from Derby Dam near Vista, Nevada, show an average annual flow of about 604,000 acre-feet during the period from 1900 to 2010 (Reclamation et al. 2008).

The east and west forks of the Carson River originate in Alpine County, California, and enter Nevada near the Carson Valley in Douglas County, where groundwater flow becomes a significant mode of flow transport in the valley (Tracy and Unger 2008). Historic annual discharge of the Carson River to Lahontan Reservoir (measured at Fort Churchill) ranges from a high of 804,600 acre-feet in 1983 to a low of 26,260 acre-feet in 1977. Average annual

discharge to Lahontan Reservoir was 276,000 acre-feet per year for the period of 1911 to 2000 (Reclamation et al. 2008). Lahontan Reservoir is located on the Carson River about 18 miles west of Fallon, Nevada, and impounds Carson River's flow. Lahontan Reservoir is the only large reservoir on the Carson River and is the only point at which the entire river's flow can be controlled. Twenty-four small alpine reservoirs on the East Fork and West Fork of the river in the upper basin have capacities between 31 and 2,400 acre-feet, with a total combined storage of 11,766 acre-feet (CDWR 1991b).

The lower Carson River flows from Lahontan Reservoir about 50 miles through Lahontan Valley. Before construction of the Newlands Project, the river terminated in the Carson Desert (Reclamation 2011j). Development in the region has altered the course of the Carson River below Lahontan Dam. Today, several individual sinks exist within the larger closed Carson River drainage basin. One channel of the Carson River turns northward near Fallon, leading to the Carson Sink playa lake. Water now reaches this portion of the basin only in the wettest years. Another channel turns southward toward a sink area known as Carson Lake and Pasture. Historically, waters of the Carson River spread over a broad region east of Fallon, creating a series of ephemeral and perennial lakes and marshes. The Stillwater NWR area is one remnant of these earlier wetlands. Settlement and agricultural development have altered the flow patterns and amount of water reaching the remaining wetlands in the sink. When flows exceed the needs of agricultural users, the excess flows reach the Carson Lake and Pasture and Stillwater NWR.

Figure 3-15 illustrates the average annual volume of flow through the Truckee and Carson basins using hydrologic data collected from various sources for years between 1901 and 2000. The subsection below, "Surface Water Management and Use," describes the relationship between the Project and hydrologic conditions in the Truckee and Carson river basins.

*This page left blank intentionally.*

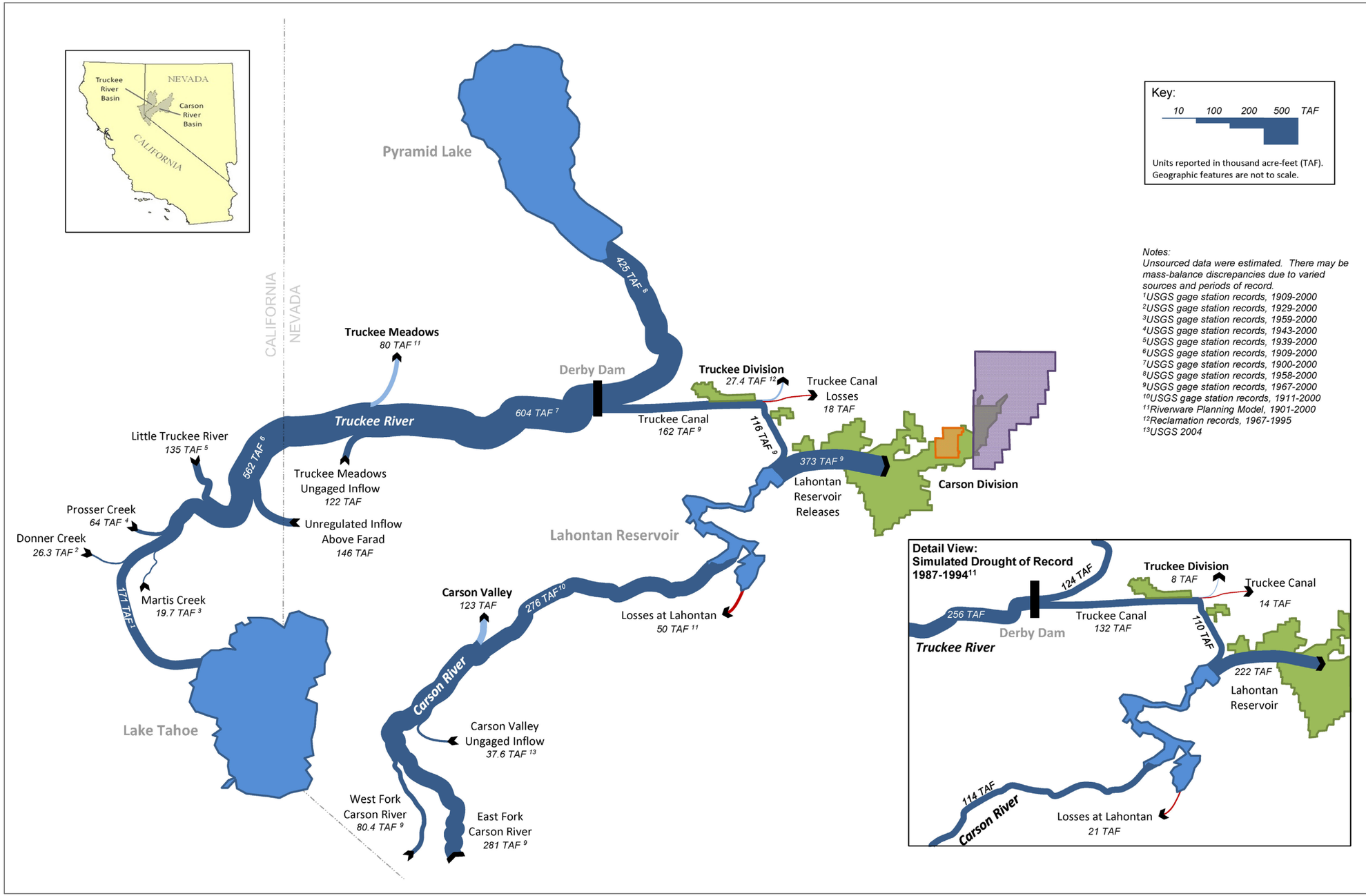



**Figure 3-15. General Depiction of Average Annual Hydrologic Conditions in the Truckee and Carson River Basins**

*This page left blank intentionally.*

### *Surface Water Management and Use*

In the primary and extended study areas, spring runoff generally occurs from April to June for the Truckee and Carson rivers. The Carson River near Fort Churchill has gone dry a number of times during dry years when upstream diversions take the river's flow. The primary rules and structures for managing most of this surface water are noted in Chapter 1 of this report, but are also described below, briefly.

Truckee River water is stored in the upper watershed in Lake Tahoe, as well as in Prosser, Stampede, and Boca reservoirs. Storage is also available in two privately owned reservoirs, Donner and Independence lakes. Reclamation regulates Lake Tahoe Dam and upper basin dams to meet Floriston rates at the Farad, California, gaging station. Similar large facilities do not exist on the upper Carson River, and management of the Carson River is distinctly different from the Truckee River.

Rights to use the surface water resources described above are established in the *Orr Ditch* Decree for the Truckee River, and the *Alpine* Decree for the Carson River. Within the extended study area, upstream from the Newlands Project, Carson and Truckee water users exercise their rights to serve municipal, agricultural, and environmental purposes. In the primary study area, however, the majority of the surface water is used by the Newlands Project.

Figure 3-15 combines a number of sources of streamflow data to illustrate the average flows through the Truckee and Carson basins. The figure highlights the Newlands Project's reliance on diversions from the Truckee River for approximately 25 percent of its average annual water supply. Historically, the Project has relied upon the Truckee River for as much as 75 percent of its water deliveries.

Average conditions, however, are not the norm. While the Newlands Project relies primarily upon the Carson River for its water supplies, periods of drought result in an increased reliance upon the Truckee River. The "Drought of Record" detail view in Figure 3-15 depicts simulated operation of the Truckee Canal during the drought of record (from 1987 to 1994). This illustrates how much the Project relies upon the Truckee River (approximately 50 percent over eight years in this case) for meeting water rights deliveries during periods of prolonged drought on the Carson River. In turn, the Project has a far greater effect on overall flow in the lower Truckee River and to Pyramid Lake during prolonged droughts. The simulated operation of the Project during the drought of record resulted in an overall diversion of just over half of the Truckee River's flow at Derby Dam.

**Newlands Project Operations** Project operations, in their basic form, occur as follows: The portion of Truckee River water which the Project may receive is diverted into the Truckee Canal. The water is then used for irrigation in the Truckee Division and, in some years is delivered to Lahontan Reservoir. Water

stored in Lahontan Reservoir is released to serve water rights holders in the Project's Carson Division. Surface water is the sole source of supply and use that is authorized for the Newlands Project; groundwater is not a source of Project supply, nor is groundwater recharge intended as a Project purpose. The aspects of Project operations most critical for this Study are those related to the Truckee Canal and to OCAP, both of which are explained below.

*Truckee Canal* The canal is operated by controlling diversions from the Truckee River at Derby Dam and through a number of hydraulic structures along the length of the canal to control flow. The canal is often checked up to various levels throughout the summer. During the winter months (December through March) the canal is checked up to make stockwater deliveries.

While the canal was originally designed and water righted to convey up to 1,500 cfs, the capacity intended for serving the Truckee and Carson divisions was 900 cfs. The 1,500 cfs design was needed for supplying 600 cfs for the irrigation of a planned third division (the Pyramid Division) from a siphon in the Derby Reach, approximately 6 miles downstream from Derby Dam on the Truckee Canal. The Truckee Canal capacity is reduced beyond this point, with an ending capacity of 900 cfs. Within the past few decades of operation, the canal has rarely conveyed more than 750 cfs. In the 12 hours preceding the 2008 breach, conveyance in the Truckee Canal ramped up very rapidly from about 350 cfs to around 750 cfs (Reclamation 2008b). As noted in the "Infrastructure" section above, TCID has operated the Fernley Reach of the canal at a maximum flow stage of 350 cfs since May 2008.

*Administration of OCAP* In addition to operations of the Truckee Canal as described above, Project operations are based on a set of rules and procedures contained in the OCAP for the Newlands Project issued by the Secretary of the Interior on December 31, 1997. In general, OCAP reflects the Federal Government's duty to support the Project water rights holders, its Indian Trust Responsibilities to the Fallon Paiute-Shoshone Tribe and Pyramid Lake Paiute Tribe, and its need to meet ESA requirements as they relate to the Truckee River and Pyramid Lake.

The main purposes of OCAP are:

- To ensure legitimate Newlands Project water rights are satisfied
- To regulate the timing and amount of water that can be diverted out of the Truckee River to serve Newlands Project water rights
- To minimize the use of the Truckee River and maximize the use of the Carson River

These purposes are met through the implementation of several provisions and components. Provisions of particular importance to the Study include:

- **Maximum Allowable Diversion** – The Maximum Allowable Diversion (MAD) places an upper limit on the total amount of water that may be diverted for Project use in a given year. The MAD is calculated annually to represent anticipated Project demand; it is based on the acres of eligible land anticipated to actually be irrigated in that year.

- **Truckee River Diversions/Lahontan Storage Targets** – The amount of Truckee River water that can be diverted at Derby Dam for Project use is calculated monthly based on demand in the Truckee Division and on the need to meet storage objectives in Lahontan Reservoir. If the storage targets are unlikely to be met, additional Truckee River water may be diverted and conveyed to Lahontan Reservoir. Lahontan Reservoir storage objectives are based on projected inflow from the Carson River, anticipated demand in the Carson Division, and delivery efficiency; OCAP dictates specific storage targets from January through June. Lahontan storage objectives are calculated monthly between July and December. Truckee River diversions are calculated monthly.

- **Conveyance System Efficiencies** – Conveyance system efficiency targets vary annually, are specified in OCAP, and consider both conveyance losses due to factors such as seepage and the amount of water actually delivered to Project users at the headgates. The efficiency requirements are higher as the percent of entitlement water actually delivered at the headgates increases.

*Precautionary Drawdowns and Spills* In some years, it is necessary for Lahontan Reservoir to release "excess" water for reasons other than irrigation. The need and criteria for making these releases is determined by TCID and Reclamation; in general, such releases are made when inflow to Lahontan Reservoir is greater than available storage capacity.

Outside the irrigation season, water from precautionary drawdowns is delivered to land, water righted or not, in the following priority: (1) Lahontan Valley wetlands, including Stillwater NWR, Fallon NWR, Carson Lake and Pasture, and the Fallon Paiute-Shoshone Indian Reservation wetlands; (2) regulating reservoirs; (3) lands. During the irrigation season, this water is made available in the following priority: (1) water-righted irrigated land; (2) regulating reservoirs; and (3) Lahontan Valley wetlands. Deliveries of this water for irrigation are charged against the user's water allocations, but deliveries for wetlands are not.

When (a) all preceding options have been used to the maximum extent possible, (b) the flows at the USGS gage on the Carson River at Tarzyn Road are forecasted to exceed 500 cfs, and (c) Reclamation determines there is a threat to

public safety, then all water released to the Project is to be available to any lands, water-righted or not, at no charge against Project allocations for that year.

**Newlands Project Water Demands** The annual volume of Project water demand is set by the "duty" of individual Project rights, the acreage of rights among each duty, and cultural practices for taking different proportions of the total water right duty.

"Duty" is the maximum amount of water, per acre, that any property has the legal right to receive on an annual basis. Water duties in the Newlands Project vary, depending upon a combination of several factors, including soil, depth to groundwater, beneficial use, conveyance efficiency, on-farm efficiency, soil slope and character, weather, and consumptive use. Table 3-13 displays all of the water duties in the Project and the related documents in which they were established.

**Table 3-13. Established Water Duties in the Newlands Project**

| Type of Use | Duty | Reference |
|---|---|---|
| Irrigated Bench Land | 4.5 acre-feet per acre | *Alpine* Decree[1] |
| Irrigated Bottom Land | 3.5 acre-feet per acre | *Alpine* Decree[1] |
| Irrigated Pasture | 1.5 acre-feet per acre | *Freeman* and *Kent* agreements[2] |
| Wetlands | 2.99 acre-feet per acre | *Alpine* Decree[1]; May 2011 Federal Court Order[3] |

*Sources*

[1] United States v. Alpine Land and Reservoir Company, 503 F.Supp. 877 *(D.Nev., 1980)*

[2] Freeman Vested Water Right Agreement, *July 21, 1919;* Kent Vested Water Right Agreement, *March 15, 1926.*

[3] *Pyramid Lake Paiute Tribe of Indians v. Nevada State Engineer, "*In Re: Nevada State Engineer Ruling No. 5759," (D.Nev., 2011)

Records indicate that the Project, at its peak, contained 73,675 acres of water righted lands. About 10,000 acres of these original rights have been permanently retired, forfeited or are identified for future retirement under the Water Rights Compensation Program, leaving approximately 63,596 acres of unretired water rights whose owners have been paying assessments to TCID. Since the 1980s, between 41,000 and 59,000 acres have been irrigated, leaving a net difference of about 4,000 acres of water rights whose owners have been paying assessments but are not receiving water. These rights have not been specifically identified by any agency or through this Study, and a thorough review of every Project water right would be needed in order to identify which may be inactive.

The Nevada State Engineer determines the validity of water rights under Nevada law and there is some uncertainty as to whether any of the 4,000 inactive water-righted acres will ever be used or transferred. The State Engineer has indicated that a right-by-right assessment would be needed to

make a certain determination of each right's validity, which would require identification and evaluation of each of the rights in question. Without a right-by-right assessment for identifying which of these rights will ultimately be forfeited and without funded programs for retiring any of these rights, this Study treats the inactive rights as potentially active. Consequently, any alternatives for the Study will need to consider the costs to serve or retire these potentially active 4,000 acres of rights.

Table 3-14 reports the acreage and volume of Project water rights demand for all potentially active water rights. Both acreages and volumes reported are drawn from the more extensive analysis documented in Appendix C (Projected Future Water Rights and Demands for the Newlands Project).

**Table 3-14. Estimated Current and Potentially Active Newlands Project Water Rights, with Associated Maximum Potential Demand[1]**

| Carson Division Rights | | Bench (acres) | Bottom (acres) | Wetland (acres) | Pasture (acres) | TOTAL Acres | Maximum Demand (acre-feet) |
|---|---|---|---|---|---|---|---|
| **Ag** | Commercial and Noncommercial Farms | 10,105 | 30,893 | 22 | 2,382 | 43,403 | 157,239 |
| | Fallon Paiute-Shoshone Irrigated Lands | - | 3,025 | - | - | 3,025 | 10,588 |
| **M&I** | City of Fallon & Churchill County | 118 | 648 | - | - | 766 | 2,799 |
| **Env** | USFWS Water Rights | -[2] | -[2] | 8,298[2] | 641 | 8,939 | 25,773 |
| | Carson Lake and Pasture | -[2] | -[2] | 2,403[2] | - | 2,403 | 7,183 |
| | Fallon Paiute-Shoshone Tribal Wetlands | - | - | 468 | - | 468 | 1,400 |
| | Carson Division Subtotal | 10,223 | 34,566 | 11,191 | 3,023 | 59,003 | 204,981 |
| **Truckee Division Rights** | | **Bench (acres)** | **Bottom (acres)** | **Wetland (acres)** | **Pasture (acres)** | **TOTAL Acres** | **Maximum Demand (acre-feet)** |
| **Ag** | Commercial and Noncommercial Farms | 2,301 | - | - | - | 2,301 | 10,355 |
| **M&I** | City of Fernley & Lyon County | 2,103 | 189 | - | - | 2,292 | 10,124 |
| | Truckee Division Subtotal | 4,404 | 189 | - | - | 4,593 | 20,479 |
| | **Total Potentially Active Newlands Project Rights** | **14,627** | **34,755** | **11,191** | **3,023** | **63,596** | **225,461** |

Notes:

[1] Figures have been rounded to their whole-number equivalents; as a result, some rounding errors may exist.

[2] TCID records indicate acreages of water rights attributed to USFWS and Carson Lake and Pasture with bench and bottom land duties. This Study assumes that these acreages will be transferred to a Wetland duty designation, and values of USFWS rights have been adjusted to reflect this assumption. Unadjusted acreages for USFWS were 15, 888, and 7,395 for bench, bottom and wetland, respectively. Unadjusted acreages for Carson Lake and Pasture were 60, 28, and 2,314 for bench, bottom and wetland, respectively.

Key:

Ag = Agricultural

Env = Environmental

M&I = Municipal and Industrial

USFWS = U.S. Fish and Wildlife Service

Given the current extent and distribution of water rights in the Project, the total estimated potential water demand in the Carson Division is approximately 204,981 acre-feet (59,003 acres) annually, and the total estimated water demand in the Truckee Division is approximately 20,479 acre-feet (4,593 acres) annually.[1]

The demands reported in Table 3-14 reflect the maximum amount that could be demanded if all potentially active Project rights are exercised. The historical cultural practice for agricultural irrigators has been to use less than the maximum water right that could be called upon. Agricultural users in the Truckee Division have historically used an average of about 95 percent of their total water rights, and agricultural users in the Carson Division have used approximately 92 percent of their total water right (43 CFR 418, 1997).

**Newlands Project Water Supply Reliability** The ability of the Newlands Project to deliver water to water rights holders in a reliable manner is a primary objective for the Study. The ability of the Project to rely upon water supplies from two sources – the Carson and Truckee rivers – has lent the Project high levels of historic delivery. Nevertheless, Project water users have experienced severe shortfalls. In seeking a performance standard that could be used to assess the ability of Study alternatives to meet the water supply objective, consideration was given to historical deliveries. However, several factors make it difficult or inappropriate to rely upon the historical Project performance. For instance, operating criteria have changed significantly over the past 50 years; both the current and future capacity of the canal are significantly lower than intended during Project construction, and ongoing programs to transfer water rights are shifting the demand for water to different uses.

To lend perspective to what the Newlands Project might have experienced during the twentieth century, this Study conducted an analysis of water supply under the current OCAP, with the historically assumed Truckee Canal capacity (900 cfs), and the current blend of water rights within the Project (Table 3-13). Under the simulated Desired Reliability scenario, the average demand met across the 100-year analysis is 95 percent. The lowest demand met is 40 percent, which would occur under conditions like those experienced in 1992 during the drought of record. In the wettest 80 out of 100 years, at least 98 percent of demand is met.

Appendix D1, "Effects of Truckee Canal Capacity on Newlands Project Water Supply," describes the results of this assessment in greater detail as the Desired Reliability scenario. Chapter 2, "Plan Formulation Process," contains additional explanation for how the Desired Reliability scenario is used in the Study, and Chapter 4, "Measures and Preliminary Alternatives," describes how the Study

[1] The Project demand assumptions for this Study differ from those included in the TROA EIS/EIR. This Study's assumptions for current and future demand are based on all potentially active water rights, regardless of whether they had been irrigated over the previous decades. See Appendix C for an explanation of the Study's assumptions and analysis to estimate Project demand.

applied the Desired Reliability scenario to guide the preliminary alternative formulation process.

### *Groundwater Resources*

Groundwater in the primary and extended study areas generally moves from recharge areas in the mountains and alluvial slopes to the valley floor (Tracy and Unger 2008). The principal groundwater aquifers are basin-fill aquifers, though a volcanic-rock aquifer near Fallon has been developed for municipal use. Basin-fill aquifers are composed primarily of alluvium, colluvium, and lacustrine deposits, and most groundwater use has been from the upper 500 feet of the aquifers (Reclamation 2011j). Groundwater from one basin may flow into another, and often there is insufficient information to fully characterize this flow between basins.

There are four general aquifer systems underlying the primary study area (Reclamation 1994). They are:

1. Shallow alluvial aquifer system extending from ground surface to about 50 feet in depth

2. Intermediate aquifer system underlying the shallow system and extending in some areas to depths of 500 to 1,000 feet

3. Basalt-aquifer system which is mushroom-shaped, almost completely enclosed by unconsolidated sediments, and related geologically to the volcanic cone located northeast of Fallon

4. Deep alluvial aquifer system generally below depths of 500 to 1,000 feet

The depth to water beneath most of the Project is less than about 25 feet below ground surface and, near irrigated areas, less than 10 feet below ground surface (Reclamation 1994). Confined conditions exist throughout much of the Carson Desert. Many deep wells have higher static ground-water levels than shallow wells, and the static water levels in these deep wells are above the top of the permeable formation which they tap, creating artesian wells, some of which flow frequently.

Surface water irrigation from the Newlands Project has altered the regimen of ground water since the early 1900s (Reclamation 1994). In 1904, the depth to water increased with increasing distance from the natural channels of the Carson River. Water levels were less than 10 feet within 2 miles of the channels and increased to about 25 feet or more in areas between the channels. In 1992, the water table had risen more than 15 feet over a large area, and near Soda Lake, ground-water levels increased more than 30 feet.

Groundwater recharge in the Fernley area is affected by (1) infiltration of precipitation, (2) infiltration from streams and canals, (3) underflow from the

nearby highlands, and (4) infiltration of irrigation water (Sinclair and Loeltz 1963, Reclamation 2000). Seepage from the Truckee Canal between Derby Dam and Lahontan Reservoir has been estimated as high as 31,000 to 35,000 acre-feet per year (Sinclair and Loeltz 1963, Reclamation 1994). In recent years of operation, between 2001 and 2010, total losses to seepage and evaporation from the Truckee Canal and its laterals have remained between 10,000 and 25,000 acre-feet per year (Appendix A).

Groundwater in the Carson River Basin above Lahontan Reservoir flows from recharge areas in the mountains and alluvial slopes to the valley floor, west to east (Tracy and Unger 2008). Specific yields are higher in the fluvial and alluvial sedimentary soils close to the river channel and the reservoir (Maurer 2011). Below Lahontan Reservoir, groundwater recharge resulting from precipitation within the Lahontan Valley is estimated at about 1,300 acre-feet per year (WRD 2003), occurring only on the eastern side of the valley. Most private wells in the basin are used for domestic purposes; irrigation needs usually are supplied by surface water. The estimated recharge from irrigation water varies from 50,000 to 100,000 acre-feet per year (Reclamation 2011j). Estimated groundwater recharge for the Fallon area is 56 percent from canal seepage, 37 percent from irrigation losses, 5 percent from precipitation, and 2 percent from Newlands Project drains (Herrera et al. 2000). Similarly, between Fallon and Stillwater Wildlife Management Area, estimated recharge is 47 percent from canal seepage, 40 percent from irrigation losses, 5 percent from precipitation, and 8 percent from Newlands Project drains (Reclamation et al. 2008).

Shallow groundwater within the Carson Division is administrated by the Nevada State Engineer. Churchill County and the U.S. Navy hold most of the rights for the shallow unconfined aquifer in this region, and use it for municipal and industrial applications. However, it is suspected that many of the residential water users within the area may also have wells.

In the extended study area, groundwater recharge in California's Martis Valley is estimated to be about 34,600 acre-feet per year (Nimbus Engineers 2001). Monitoring wells adjacent to the Truckee River indicate that groundwater is moving into the river (Nimbus Engineers 2001). Most groundwater pumping in the Truckee River Basin occurs in Truckee Meadows, which is used to supplement the municipal surface water supply for the cities of Reno and Sparks. Estimated groundwater recharge in Truckee Meadows is 29,000 acre-feet per year and comes from infiltration of precipitation (mainly snowmelt); irrigation return flows; and seepage from ditches, canals, and streambeds (Reclamation et al. 2008).

In the Dixie Valley, approximately 35 miles east of Fallon, the perennial groundwater yield has been estimated to be as low as 18,000 acre-feet per year (Mahannah 2005) or as high as 50,000 acre-feet per year (WRD 2003). Currently, the U.S. Navy holds about 14,000 acre-feet of permitted and

certificated groundwater rights, of which at least 6,000 may be in forfeiture (Mahannah 2005), and Churchill County has pending applications for over 56,000 acre-feet (Reclamation 2011j). A number of export studies have been conducted to assess transport of Dixie Valley groundwater to Stillwater NWR or to Lahontan Reservoir for use in the Lahontan Valley (Mahannah 2005, Churchill County 2003a and 2007).

### *Water Quality*

From Lake Tahoe to Reno, the Truckee River basin is relatively pristine. The primary water quality concern for the reach from Lake Tahoe to Reno is the potential for warm water temperatures downstream from the discharges of Tahoe-Truckee Sanitation Agency (TTSA) and Truckee Meadows Water Reclamation Facility (TMWRF), particularly during periods of low flow (Reclamation et al. 2008). The 1996 WQSA establishes actions, such as water storage and releases during low-flow conditions, to meet water quality objectives for nutrients and dissolved oxygen. The Truckee River total maximum daily load (TMDL) addresses total nitrogen, total phosphorus, and total dissolved solids upstream from Lockwood, Nevada. Water diverted at Derby Dam, from the diversion to Truckee Canal, has an average turbidity of 7.0 nephelometric turbidity units (NTU), total dissolved solids (TDS) of less than 200 parts per million, and arsenic concentrations of 14 parts per billion (WRD 2003).

The Carson River, from New Empire in Carson City to the Carson Sink, is listed on the National Priorities List because of mercury contamination from historic mining (Reclamation 2011j). The State of Nevada recommends no consumption of any fish from any waters in the Lahontan Valley due to elevated mercury levels (NDOW 2010, Reclamation 2011j). The Carson River TMDL addresses total phosphorus, turbidity, and total suspended solids upstream from Lahontan Reservoir. Lahontan Reservoir water turbidity varies from about 5 to 200 NTU, with an average of about 30 NTU (NDEP 2013). Water in the reservoir has low salinity, with TDS less than 300 milligrams per liter (WRD 2003). Lahontan Reservoir currently meets Nevada water quality standards for arsenic (50 micrograms per liter (µg/l)) under the Clean Water Act, however arsenic levels are typically higher than the Safe Drinking Water Act of maximum containment level (MCL) of 10 µg/l (NDEP 2013). No trihalomethane limitations have been identified, although trihalomethane precursors (algae) are present. The water in the reservoir currently meets Nevada's pathogen (*E. coli*) water quality standards for the protection of contact recreation.

In and below the Newlands Project, Stillwater NWR receives irrigation return flows and drain water. Nevada requires that irrigation return flows meet State agricultural water quality standards; drain water standards are less stringent. USFWS owns water rights for Stillwater NWR and will take irrigation return flows to meet those rights as long as the water quality is within Nevada standards. USFWS cannot refuse to use Stillwater NWR for disposal of drain

water unless they determine that the water is toxic to migratory birds (USFWS 1996a).

Below the surface, soil salinity in the primary study area sediments impairs groundwater quality. Typically, groundwater quality decreases with depth, and potable supplies must be taken from basin margins or higher elevation valleys (Reclamation 2011j). Sediments in the Fernley area contain highly soluble mineral salts. Previous studies noted that the concentration of dissolved solids of water in the Truckee Canal was recorded at 128 parts per million (ppm) while water sampled from a pond located downgradient from the canal had a dissolved solids concentration of more than 3,200 ppm (Tracy and Unger 2008). Related analyses of 31 groundwater wells in the Fernley area showed dissolved solids concentrations ranging from 163 ppm to 4,190 ppm (Reclamation 2000). Lahontan Valley and Dixie Valley groundwater meet Nevada drinking water standards, except for arsenic in Lahontan Valley, and arsenic and fluoride in Dixie Valley (Reclamation 2011j).

## Likely Future Without-Action Conditions

As noted in the "Biological Environment" and "Socioeconomic Environment" sections above, anticipated shifts in ownership of Project water-righted acres from agricultural application to wetland management practices, environmental purposes, and municipal dedications, will result in overall reduction of Project water demand in the primary study area (Appendix C). For the purpose of this Study, alternatives described in Chapter 5 were constructed and evaluated with the assumption that agricultural water right demands would continue the historical cultural practice of using a reduced (95 percent) portion of their maximum water rights volume. All other water rights holders were assumed to use their full maximum demand. This assumption intends to capture the likely demand for the anticipated acreage of agricultural water rights as shown in Table 3-15, and should not be construed as a diminishment of the water rights.

**Table 3-15. Projected Future Potentially Active Newlands Project Water Rights, with Associated Demand[1]**

| Carson Division Rights | | Bench (acres) | Bottom (acres) | Wetland (acres) | Pasture (acres) | TOTAL Acres | Demand (acre-feet) |
|---|---|---|---|---|---|---|---|
| Ag | Commercial and Noncommercial Farms | 9,830 | 19,104 | 22 | 2,382 | 31,338 | 105,560[3] |
| | Fallon Paiute-Shoshone Irrigated Lands | - | 3,025 | - | - | 3,025 | 10,588 |
| M&I | City of Fallon & Churchill County | 118 | 648 | - | - | 766 | 2,799 |
| Env | USFWS Water Rights | -[2] | -[2] | 20,362[2] | 641 | 21,003 | 61,844 |
| | Carson Lake and Pasture | -[2] | -[2] | 2,403[2] | - | 2,403 | 7,183 |
| | Fallon Paiute-Shoshone Tribal Wetlands | - | - | 468 | - | 468 | 1,400 |
| | Carson Division Subtotal | 9,948 | 22,778 | 23,255 | 3,023 | 59,003 | 189,734 |
| **Truckee Division Rights** | | **Bench (acres)** | **Bottom (acres)** | **Wetland (acres)** | **Pasture (acres)** | **TOTAL Acres** | **Demand (acre-feet)** |
| Ag | Commercial and Noncommercial Farms | 1,451 | - | - | - | 1,451 | 6,204[3] |
| M&I | City of Fernley & Lyon County | 2,353 | 189 | - | - | 2,542 | 11,249 |
| | Truckee Division Subtotal | 3,804 | 189 | - | - | 3,993 | 17,435 |
| | **Total Potentially Active Newlands Project Rights** | **13,752** | **22,966** | **23,255** | **3,023** | **62,996** | **206,827** |

Notes:

[1] Figures have been rounded to their whole-number equivalents; as a result, some rounding errors may exist.

[2] TCID records indicate acreages of water rights attributed to USFWS and Carson Lake and Pasture with bench and bottom land duties. This Study assumes that these acreages will be transferred to a Wetland duty designation, and values of USFWS rights have been adjusted to reflect this assumption. Unadjusted projected acreages for USFWS are 290, 12,667, and 7,395 for bench, bottom, and wetland, respectively. Unadjusted acreages for Carson Lake and Pasture are 60, 28, and 2,314 for bench, bottom, and wetland, respectively.

[3] Demand for agricultural water rights holders reflect historical cultural practice of receiving less than the full water right: 95% of total water right demand for Truckee Division and 92% for Carson Division.

Key:
Ag = Agricultural
Env = Environmental
M&I = municipal and industrial
USFWS = U.S. Fish and Wildlife Service

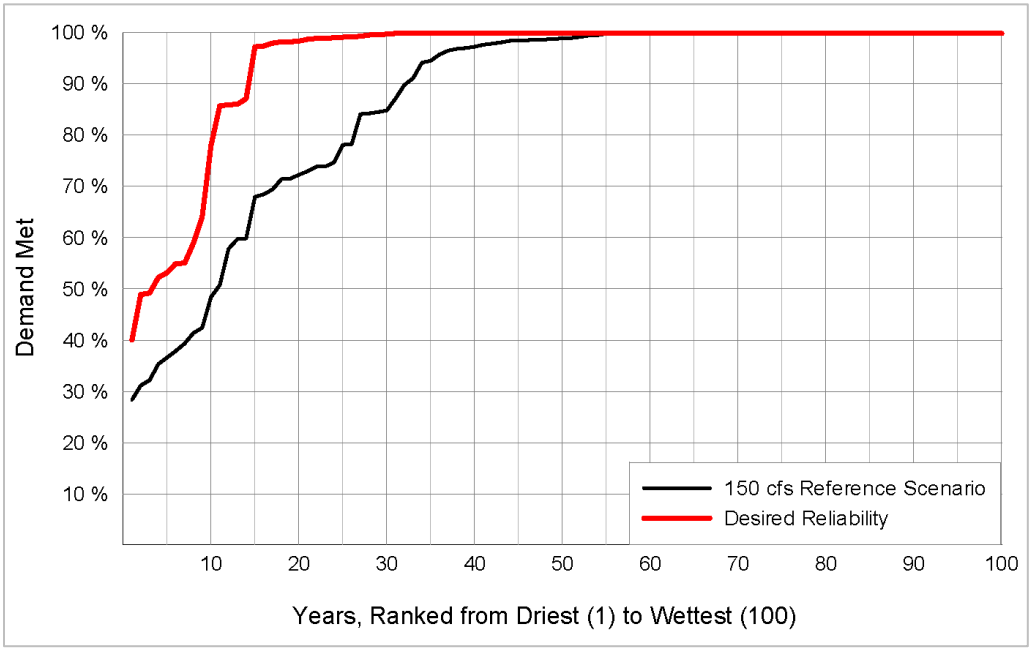
The 150 cfs flow-stage Truckee Canal capacity restriction, described in the "Infrastructure" section above, will have a large effect on the Project's overall reliability and ability to meet demand from agricultural and other users.

Pressure from regional stakeholders will continue to increase efficiencies of Project water use for agriculture, including reuse of agricultural drain water. Increases in efficiencies would likely result in reductions to both groundwater recharge and drain flows to the Stillwater NWR. Reductions in groundwater recharge could result in reductions in water surface tables that allow for some rights holders to petition for their lands currently classified as bottom lands to

be reclassified as bench lands. Reclassification could result in increased total demand for water for the Carson Division; however, the efficiency gains that would lead to this increase would also provide overall greater water supply reliability for the division (Appendix D4).

***Key Study Assumptions***

Water demand for agricultural uses within the Project will decrease, and Project efficiency will likely increase, but neither will offset the reductions in overall water supply reliability experienced by Project water rights holders as a result of the restricted flow stage (150 cfs) in the Truckee Canal (see Figure 3-16). Shortfalls will be more frequent and more severe overall. Long-term average Project water deliveries will be reduced 8 percent from 95 percent (under the Desired Reliability scenario) to 87 percent. During the driest 20 percent of years, Project rights holders would receive an average of 51 percent of their water rights each year, a 23 percent greater shortfall than experienced under the Desired Reliability. Appendices B2 and D1 contain the detailed analyses used to develop these assumptions.




Key: cfs = cubic feet per second

**Figure 3-16. Potential for Shortages Under the Likely Future Without-Action Condition**

As noted above, agricultural water right demands will continue the historical cultural practice of using a reduced (95 percent) portion of their maximum water rights volume, as reflected in Table 3-15. All other water rights holders were assumed to use their full maximum demand.